Dell™ PowerEdge™ *SC*440 Systems

Hardware Owner's Manual

Notes, Notices, and Cautions

NOTE: A NOTE indicates important information that helps you make better use of your computer.

NOTICE: A NOTICE indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

CAUTION: A CAUTION indicates a potential for property damage, personal injury, or death.

Contents

1

About Your System

This section describes the physical, firmware, and software interface features that provide and ensure the essential functioning of your system. The physical connectors on your system's front and back panels provide convenient connectivity and system expansion capability. The system firmware, applications, and operating system monitor the system and component status and alert you when a problem arises. System conditions can be reported by any of the following:

- Front or back panel indicators
- System messages
- Warning messages
- Diagnostics messages
- Alert messages

This section describes each type of message, lists the possible causes, and provides steps to resolve any problems indicated by a message. The system indicators and features are illustrated in this section.

Other Information You May Need

⚠ **CAUTION: The *Product Information Guide* provides important safety and regulatory information. Warranty information may be included within this document or as a separate document.**

- The *Getting Started Guide* provides an overview of system features, setting up your system, and technical specifications.
- CDs included with your system provide documentation and tools for configuring and managing your system.
- Systems management software documentation describes the features, requirements, installation, and basic operation of the software.
- Operating system documentation describes how to install (if necessary), configure, and use the operating system software.
- Documentation for any components you purchased separately provides information to configure and install these options.
- Updates are sometimes included with the system to describe changes to the system, software, and/or documentation.

  ✎ **NOTE:** Always check for updates on **support.dell.com** and read the updates first because they often supersede information in other documents.

- Release notes or readme files may be included to provide last-minute updates to the system or documentation or advanced technical reference material intended for experienced users or technicians.

Accessing System Features During Startup

Table 1-1 describes keystrokes that may be entered during startup to access system features. If your operating system begins to load before you enter the keystroke, allow the system to finish booting, and then restart your system and try again.

Table 1-1. Keystrokes for Accessing System Features

Keystroke	Description
<F2>	Enters the System Setup program. See "Using the System Setup Program" on page 27.
<F10>	Opens the utility partition, allowing you to run the system diagnostics. See "Running the System Diagnostics" on page 98.
<F11>	Enters the boot menu selection screen, allowing you to choose a boot device.
<F12>	Initiates PXE boot.
<Ctrl+C>	Option is displayed for some SAS controller expansion cards. Enters the SAS Configuration Utility, which includes RAID configuration options. See your SAS adapter *User's Guide* for more information.
<Ctrl+S>	Option is displayed only if you have PXE support enabled through the System Setup Program (see Table 2-1). This keystroke allows you to configure NIC settings for PXE boot. For more information, see the documentation for your integrated NIC.

Front-Panel Features and Indicators

Figure 1-1 shows the controls, indicators, and connectors located on the system's front panel. Table 1-2 provides component descriptions.

Figure 1-1. Front-Panel Features and Indicators
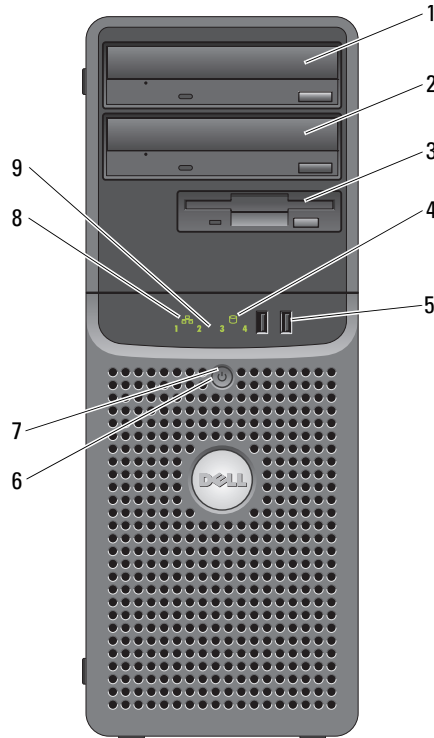
Table 1-2. Front-Panel Components

Item	Component	Icon	Description
1	upper 5.25-inch drive bay		Holds an optical drive.
2	lower 5.25-inch drive bay		Holds an optional optical or tape backup unit drive.
3	flex bay		Holds an optional diskette drive.
4	hard-drive activity indicator		Indicates hard drive activity.

Table 1-2. Front-Panel Components *(continued)*

Item	Component	Icon	Description
5	USB connectors (2)		Connects USB 2.0-compliant devices to the system.
6	power button		The power button controls the DC power supply output to the system. **NOTE:** If you turn off the system using the power button and the system is running an ACPI-compliant operating system, the system performs a graceful shutdown before the power is turned off. If the system is not running an ACPI-compliant operating system, the power is turned off immediately after the power button is pressed.
7	power light		No light — The system is off. Steady green — The system is powered on. Blinking green — The system is in a low power state. Steady amber — The power supply is probably good. Blinking amber — The system is powering up. • If the hard drive indicator is off, the power supply may need to be replaced. • If the hard drive indicator is on, the system board is faulty. Check the diagnostic indicators to see if the specific problem is identified. See "Diagnostic Lights" on page 15.
8	network link light		Lights when the system is linked to a network.
9	diagnostic lights (4)		Display light-pattern codes to assist in troubleshooting system problems. See "Diagnostic Lights" on page 15.

Back-Panel Features and Indicators

Figure 1-2 shows the controls, indicators, and connectors located on the system's back panel.

Figure 1-2.   Back-Panel Features and Indicators
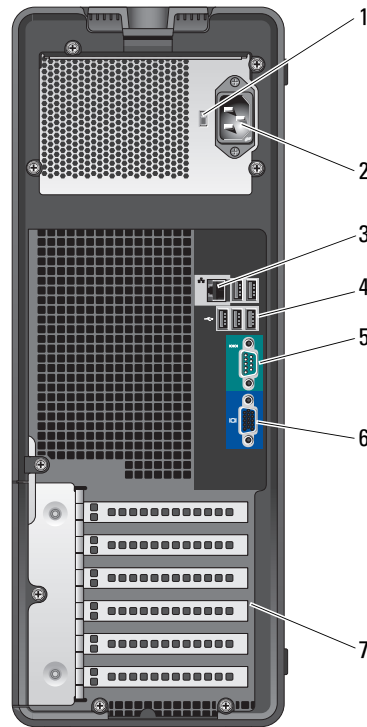
1	voltage selection switch	2	power connector	3	NIC connector
4	USB connectors (5)	5	serial connector	6	video connector
7	I/O expansion-card slots (5)				

Connecting External Devices

When connecting external devices to your system, follow these guidelines:

- Most devices must be connected to a specific connector and device drivers must be installed before the device operates properly. (Device drivers are normally included with your operating system software or with the device itself.) See the documentation that accompanied the device for specific installation and configuration instructions.

- Always attach an external device while your system and the device are turned off. Next, turn on any external devices before turning on the system (unless the documentation for the device specifies otherwise).

See "Using the System Setup Program" on page 27 for information about enabling, disabling, and configuring I/O ports and connectors.

NIC Indicator Codes

The NIC on the back panel has an indicator that provides information on network activity and link status. See Figure 1-3. Table 1-3 lists the NIC indicator codes.

Figure 1-3. NIC Indicators

| 1 | link indicator | 2 | activity indicator |
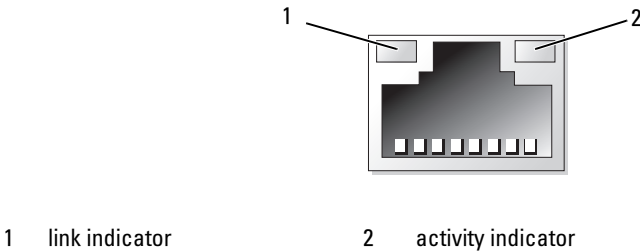
Table 1-3. NIC Indicator Codes

Indicator Type	Indicator Code	Description
Activity	Off	When off at the same time that the link indicator is off, the NIC is not connected to the network or the NIC is disabled in the System Setup program. See "Using the System Setup Program" on page 27.
	Blinking	Indicates that network data is being sent or received.
Link	Off	When off at the same time that the activity indicator is off, the NIC is not connected to the network or the NIC is disabled in the System Setup program. See "Using the System Setup Program" on page 27.
	Yellow	1000-Mbps connection
	Orange	100-Mbps connection
	Green	10-Mbps connection

Power Supply Indicators

The voltage selection switch on the back panel of the system allows you to select one of two primary voltage inputs. Ensure that the switch is set to the proper voltage according to Table 1-4.

Table 1-4.   Voltage Selection Switch

If your power source is:	The voltage selection switch should be set to:
110 V	115
220 V	230

For information on system power requirements, see "Technical Specifications" in your *Getting Started Guide*.

Diagnostic Lights

The four diagnostic indicator lights on the system front panel display error codes during system startup. Table 1-5 lists the causes and possible corrective actions associated with these codes. A highlighted circle indicates the light is on; a non-highlighted circle indicates the light is off.

NOTE: Once the system completes POST, all diagnostic lights will be OFF.

Table 1-5.   Diagnostic Indicator Codes

Code	Causes	Corrective Action
①②③④	The computer is in a normal off condition or a possible pre-BIOS failure has occurred. The diagnostic lights are not lit after the system successfully boots to the operating system.	Plug the computer into a working electrical outlet and press the power button.
①②**③**④	Possible processor failure.	See "Troubleshooting the Microprocessor" on page 95.
①②**③④**	Memory failure.	See "Troubleshooting System Memory" on page 87.
①**②**③④	Possible expansion card failure.	See "Troubleshooting Expansion Cards" on page 93.

Table 1-5. Diagnostic Indicator Codes *(continued)*

Code	Causes	Corrective Action
①②③④ (2, 4 green)	Possible video failure.	See "Getting Help" on page 107.
①②③④ (2, 3 green)	Diskette drive or hard drive failure.	Ensure that the diskette drive and hard drive are properly connected. See "Hard Drives" on page 51 or "Diskette Drive" on page 44 for information on the drives installed in your system.
①②③④ (2, 3, 4 green)	Possible USB failure.	See "Troubleshooting a USB Device" on page 82.
①②③④ (1 green)	No memory modules detected.	See "Troubleshooting System Memory" on page 87.
①②③④ (1, 4 green)	System board failure.	See "Getting Help" on page 107.
①②③④ (1, 3 green)	Memory configuration error.	See "Troubleshooting System Memory" on page 87.
①②③④ (1, 3, 4 green)	Possible system board resource and/or system board hardware failure.	See "Getting Help" on page 107.
①②③④ (1, 2 green)	Possible system resource configuration error.	See "Troubleshooting IRQ Assignment Conflicts" on page 80. If the problem persists, see "Getting Help" on page 107.
①②③④ (1, 2, 3 green)	Other failure.	Ensure that the diskette drive, optical drive, and hard drives are properly connected. See "Troubleshooting Your System" on page 79 for the appropriate drive installed in your system. If the problem persists, see "Getting Help" on page 107.

System Messages

System messages appear on the screen to notify you of a possible problem with the system. Table 1-6 lists the system messages that can occur and the probable cause and corrective action for each message.

NOTE: If you receive a system message that is not listed in Table 1-6, check the documentation for the application that is running when the message appears or the operating system's documentation for an explanation of the message and recommended action.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

Table 1-6. System Messages

Message	Causes	Corrective Actions
`A filename cannot contain any of the following characters:` `\ / : * ? " < > |`		Do not use these characters in filenames.
`A required .DLL file was not found`	The application that you are trying to open is missing an essential file.	Remove and then reinstall the application. See the application's documentation for installation instructions.
`Alert! CPU fan not detected`	The processor cooling fan is faulty or the fan assembly is not installed correctly.	Ensure that the processor cooling fan is properly installed. See "Troubleshooting System Cooling Problems" on page 86.
`Alert! Previous reboot was due to voltage regulator failure`		See "Getting Help" on page 107.
`Alert! System battery voltage is low`		Replace the battery. See "Troubleshooting the System Battery" on page 85.
`Alert! Unable to initial-` `ize all installed memory`	One or more memory modules might be faulty or improperly seated.	See "Troubleshooting System Memory" on page 87. If the problem persists, see "Getting Help" on page 107.
`Alert! Card-cage fan failure.`	A card-cage fan is not detected during POST. The system will halt at the <F1>/<F2> prompt even if **Keyboard Errors Report** option is disabled in the System Setup program.	See "Troubleshooting System Cooling Problems" on page 86.
`Alert! Chipset heat sink not detected.`		Ensure heatsink and shroud assembly are properly attached. See Figure 3-15.
`Alert! Cover was previously removed.`	The system was opened.	Information only. To reset the chassis intrusion switch, see "Using the System Setup Program" on page 27.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
`Alert! CPU fan failure.`	The processor cooling fan is faulty or the fan assembly is not installed correctly.	Ensure that the processor cooling shroud is properly installed. See "Troubleshooting System Cooling Problems" on page 86 and "Microprocessor" on page 62.
`Alert! Error initializing PCI Express slot n (or bridge).`	The system encountered a problem while trying to configure a PCIe expansion card.	See "Troubleshooting Expansion Cards" on page 93.
`Alert! Incompatible processor detected.`		Use only Dell supported processors. See the *Getting Started Guide* for a list of supported processors.
`Alert! OS Install Mode enabled. Amount of available memory limited to 256MB.`	The **OS Install Mode** option in the System Setup program is set to **On**. This limits the amount of available memory to 256 MB because some operating systems will not complete installation with more than 2 GB of system memory.	After the operating system is installed, enter the System Setup program and set the **OS Install Mode** option to **Off**. See "Using the System Setup Program" on page 27.
`Alert! Previous fan failure.`	The fan caused errors the last time the system was used.	Ensure that nothing is blocking the airflow vents and that all fans are properly installed and operating correctly. See "Troubleshooting System Cooling Problems" on page 86.
`Alert! Previous attempts at booting this system have failed at checkpoint [nnnn]. For help in resolving this problem, please note this checkpoint and contact Dell Technical Support.`	The system failed to complete the boot routine three consecutive times for the same error.	See "Getting Help" on page 107.
`Alert! Previous Processor Thermal Failure`	The processor overheated the last time the system was used.	Ensure that nothing is blocking the airflow vents and that all fans are properly installed and operating correctly. Also, ensure that the processor heat sink is properly installed. See "Microprocessor" on page 62.

Table 1-6.   System Messages *(continued)*

Message	Causes	Corrective Actions
`Alert! Previous Shutdown Due to Thermal Event`	The processor or hard drive overheated the last time the system was used.	Ensure that nothing is blocking the airflow vents and that all fans are working correctly. Also, ensure that the processor heat sink is properly installed. See "Microprocessor" on page 62.
`Alert! Uncorrectable Memory Error Previously Detected... Address XXXXXXXX`H`, Device DIMM_`Y	One or more memory modules might be improperly seated or faulty, or the system board may be faulty.	See "Troubleshooting System Memory" on page 87. If the problem persists, see "Getting Help" on page 107.
`Attachment failed to respond`	The diskette or hard-drive controller cannot send data to the associated drive.	See "Troubleshooting a Diskette Drive" on page 89 or "Troubleshooting a Hard Drive" on page 91.
`Bad command or file name`		Ensure that you have spelled the command correctly, have put spaces in the proper place, and have used the correct pathname.
`Bad error-correction code (ECC) on disk read`	The diskette or hard-drive controller detected an uncorrectable read error.	See "Troubleshooting a Diskette Drive" on page 89 or "Troubleshooting a Hard Drive" on page 91.

`bb/dd/f: Error allocating IRQ for PCI Device`
 	
`bb/dd/f: Error allocating I/O BAR for PCI Device`
 	
`bb/dd/f: Error allocating Mem BAR for PCI Device`
 	
`bb/dd/f: Error allocating PMem BAR for PCI Device`
 	
`bb/dd/f: Error allocating UMB for PCI Device`
 	
NOTE: *bb* is the bus number, *dd* is the device number, and *f* is the function number. All numbers are hexadecimal.
	The system encountered a problem while trying to configure an expansion card or integrated on-board devices.	If the device number points to an expansion card, the card can be removed. See "Troubleshooting Expansion Cards" on page 93.
		
		If the device number points to a an on-board device, disable the device. See "Using the System Setup Program" on page 27.

`Controller has failed`	The hard drive or the associated controller is defective.	See "Troubleshooting a Hard Drive" on page 91.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
`Data error`	The diskette drive or hard drive cannot read the data.	For the operating system, run the appropriate utility to check the file structure of the diskette drive or hard drive. See your operating system documentation for information on running these utilities.
`Decreasing available memory`	One or more memory modules might be faulty or improperly seated.	Reinstall the memory modules and, if necessary, replace them. See "Troubleshooting System Memory" on page 87.
`Diskette drive 0 seek failure`	A cable might be loose or the system configuration information might not match the hardware configuration.	See "Troubleshooting a Diskette Drive" on page 89.
`Diskette read failure`	The diskette might be defective, or a cable might be loose.	If the diskette-drive indicator turns on, try a different disk. See "Troubleshooting a Diskette Drive" on page 89.
`Diskette subsystem reset failed`	The diskette drive controller might be faulty.	Run the system diagnostics. See "Running the System Diagnostics" on page 98.
`Diskette write protected`	The diskette is write-protected.	Slide the write-protect notch to the open position.
`Drive not ready`	No diskette is in the drive.	Insert a diskette in the drive.

`Error auto-sensing primary master hard disk drive`
 	
`Error auto-sensing primary slave hard disk drive`
 	
`Error auto-sensing secondary master hard disk drive`
 	
`Error auto-sensing secondary slave hard disk drive`
		See "Troubleshooting a Hard Drive" on page 91.

`Floppy diskette seek failure`	A diskette drive is not connected but is enabled in the BIOS setup menu. The diskette in the drive is faulty.	See "Troubleshooting a Diskette Drive" on page 89.
`Gate A20 failure`	Faulty keyboard controller (faulty system board).	See "Getting Help" on page 107.

Table 1-6.   System Messages *(continued)*

Message	Causes	Corrective Actions
General failure	The operating system is unable to carry out the command.	This message is usually followed by specific information. Take the appropriate action to resolve the problem.
Hard-disk configuration error Hard-disk controller failure Hard-disk drive failure	The hard drive failed initialization.	Run the system diagnostics. See "Running the System Diagnostics" on page 97. Also, see "Troubleshooting a Hard Drive" on page 91.
Drive x not found: Serial (or Parallel) ATA, SATA- (or PATA-)n **NOTE:** *x* is the drive number (0-6) and *n* is SATA0-3 or PATA0-1.		Run the system diagnostics. See "Running the System Diagnostics" on page 97. Also, see "Troubleshooting a Hard Drive" on page 91.
Insert bootable media	The operating system is trying to boot from a nonbootable diskette or CD.	Insert a bootable diskette or CD.
Invalid configuration information - please run SETUP program	The system configuration information does not match the hardware configuration.	Enter the System Setup program and correct the system configuration information. See "Using the System Setup Program" on page 27.
Keyboard Controller Failure Keyboard Stuck Key Failure Keyboard failure	A cable or connector might be loose, or the keyboard or keyboard/mouse controller might be faulty.	See "Troubleshooting the Keyboard" on page 81.
Keyboard fuse has failed.		See "Troubleshooting the Keyboard" on page 81.
Memory address line failure at *address*, read *value* expecting *value*	A memory module might be faulty or improperly seated.	Reinstall the memory modules and, if necessary, replace them. See "Troubleshooting System Memory" on page 87.
Memory allocation error	The software you are attempting to run is conflicting with the operating system, another program, or a utility.	Turn off the system, wait 30 seconds, restart the system, and then try to run the program again. If the error message appears again, see the software documentation for additional troubleshooting suggestions.

Table 1-6.   System Messages *(continued)*

Message	Causes	Corrective Actions

`Memory data line failure at address, read value expecting value`
 	
`Memory double word logic failure at address, read value expecting value`
 	
`Memory odd/even logic failure at address, read value expecting value`
 	
`Memory write/read failure at address, read value expecting value`
	A memory module might be faulty or improperly seated.	Reinstall the memory modules and, if necessary, replace them. See "Troubleshooting System Memory" on page 87.

`Memory size in CMOS invalid`	The amount of memory recorded in the system configuration information does not match the memory installed in the system.	Restart the system. If the error message appears again, see "Troubleshooting System Memory" on page 87. If the problem persists, see "Getting Help" on page 107.
`Memory type or speed is not supported on this system. Please refer to system documentation for support memory configurations.`		See "Troubleshooting System Memory" on page 87.
`NIC failure.`		See "Troubleshooting a NIC" on page 83.
`No boot device available`	The system cannot find the diskette or hard drive.	If the diskette drive is your boot device, ensure that a bootable disk is in the drive. If the hard drive is your boot device, ensure that the hard drive is installed, the interface cable is properly connected, and the hard drive is partitioned as a boot device. Enter the System Setup program and verify the boot sequence information. See "Using the System Setup Program" on page 27.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
`No boot sector on hard-disk drive`	The system configuration information in the System Setup program might be incorrect.	Enter the System Setup program and verify the system configuration information for the hard drive. See "Using the System Setup Program" on page 27.
		If the message continues to appear after verifying the information in the System Setup program, the operating system might have been corrupted. Reinstall the operating system. See your operating system documentation for reinstallation information.
`No timer tick interrupt`	A chip on the system board might be malfunctioning.	Run the system diagnostics. See "Running the System Diagnostics" on page 97.
`Non-system disk or disk error`	The diskette in the diskette drive or your hard drive does not have a bootable operating system installed on it.	Replace the diskette with one that has a bootable operating system or remove the diskette, and then restart the system.
		If the problem persists, see "Troubleshooting a Diskette Drive" on page 89 or "Troubleshooting a Hard Drive" on page 91.
		If the problem persists, see "Getting Help" on page 107.
`Not a boot diskette`	The operating system is trying to boot from a diskette that does not have a bootable operating system installed on it.	Insert a diskette that has a bootable operating system.
`Not enough memory or resources. Close some programs and try again.`	You have too many programs open.	Close all windows and open the program that you want to use. In some cases, you might have to restart your system to restore system resources. If so, try opening the program that you want to use first
`Mixing ECC and non-ECC DIMMs is not supported on this platform`		See "Troubleshooting System Memory" on page 87. If the problem persists, see "Getting Help" on page 107.

Table 1-6.   System Messages *(continued)*

Message	Causes	Corrective Actions
`Operating system not found`		See "Troubleshooting a Hard Drive" on page 91. If the problem persists, see "Getting Help" on page 107.
`Please connect USB keyboard/mouse to USB ports on the back of the computer`	The keyboard and/or mouse is not properly connected.	See "Troubleshooting a USB Device" on page 82.
`Plug and play configuration error`	An attached device is improperly configured.	See "Troubleshooting Your System" on page 79.
`Read fault`	The operating system cannot read from the diskette or hard drive, the system could not find a particular sector on the disk, or the requested sector is defective.	See "Troubleshooting a Diskette Drive" on page 89 or "Troubleshooting a Hard Drive" on page 91.
`Requested sector not found`	The operating system cannot read from the diskette or hard drive, the system could not find a particular sector on the disk, or the requested sector is defective.	See "Troubleshooting a Diskette Drive" on page 89 or "Troubleshooting a Hard Drive" on page 91.
`Reset failed`	The disk reset operation failed.	See "Troubleshooting a Diskette Drive" on page 89 or "Troubleshooting a Hard Drive" on page 91.
`Sector not found` `Seek error`	A faulty diskette drive or hard drive.	See "Troubleshooting a Diskette Drive" on page 89 or "Troubleshooting a Hard Drive" on page 91.
`Shutdown failure`	A chip on the system board might be malfunctioning.	Run the system diagnostics. See "Running the System Diagnostics" on page 97.
`The amount of system memory has changed`	Memory has been added or removed, or a memory module may be faulty.	If memory has been added or removed, this message is informative and can be ignored. If memory has not been added or removed, check the SEL to determine if single-bit or multi-bit errors were detected and replace the faulty memory module. See "Troubleshooting System Memory" on page 87.
`The file being copied is too large for the destination drive.`	The file that you are trying to copy is too large to fit on the disk.	Try increasing disk space on the destination drive by deleting unnecessary files.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
`Time-of-day clock stopped`	The battery might be faulty.	See "Troubleshooting the System Battery" on page 85.
`Time-of-day not set`	The time or date stored in the System Setup program does not match the system clock.	Enter the System Setup program and correct the **Date** and **Time** options. See "Using the System Setup Program" on page 27. If the problem persists, see "Troubleshooting the System Battery" on page 85.
`Timer chip counter 2 failed`	A chip on the system board might be malfunctioning.	Run the system diagnostics. See "Running the System Diagnostics" on page 97.
`Unexpected interrupt in protected mode`		Run the system diagnostics. See "Running the System Diagnostics" on page 97.
`Write fault` `Write fault on selected drive`	The operating system cannot write to the diskette drive or hard drive.	See "Troubleshooting a Diskette Drive" on page 89 or "Troubleshooting a Hard Drive" on page 91.
`<drive letter>:\ is not accessible. The device is not ready.`	The diskette drive cannot read the diskette.	Insert a diskette into the drive or replace the existing diskette, and try again.

Warning Messages

A warning message alerts you to a possible problem and prompts you to respond before the system continues a task. For example, before you format a diskette, a message will warn you that you may lose all data on the diskette. Warning messages usually interrupt the task and require you to respond by typing `y` (yes) or `n` (no).

> **NOTE:** Warning messages are generated by either the application or the operating system. For more information, see the documentation that accompanied the operating system or application.

Diagnostics Messages

When you run system diagnostics, an error message may result. Diagnostic error messages are not covered in this section. Record the message on a copy of the Diagnostics Checklist in "Getting Help" on page 107, and then follow the instructions in that section for obtaining technical assistance.

Alert Messages

Systems management software generates alert messages for your system. Alert messages include information, status, warning, and failure messages for drive, temperature, fan, and power conditions. For more information, see the systems management software documentation.

2

Using the System Setup Program

After you set up your system, run the System Setup program to familiarize yourself with your system configuration and optional settings. Record the information for future reference.

You can use the System Setup program to:

- Change the system configuration stored in NVRAM after you add, change, or remove hardware
- Set or change user-selectable options—for example, the time or date
- Enable or disable integrated devices
- Correct discrepancies between the installed hardware and configuration settings

Entering the System Setup Program

During System Setup

1 Turn on or restart your system.

2 Press <F2> immediately after you see the following message:

   `<F2> = System Setup`

   If your operating system begins to load before you press <F2>, allow the system to finish booting, and then restart your system and try again.

   NOTE: To ensure an orderly system shutdown, see the documentation that accompanied your operating system.

Responding to Error Messages

You can enter the System Setup program by responding to certain error messages. If an error message appears while the system is booting, make a note of the message. Before entering the System Setup program, see "System Messages" on page 16 for an explanation of the message and suggestions for correcting errors.

NOTE: After installing a memory upgrade, it is normal for your system to send a message the first time you start your system.

Navigating the System Setup Program

Table 2-1 lists the keys that you use to view or change information on the System Setup screens, and to exit the program.

Table 2-1. System Setup Program Navigation Keys

Keys	Action
Up arrow and down arrow	Moves to the previous or next field
Left arrow and right arrow	Moves left or right in a field
<+> and <–> keys	Opens and closes submenus
<Enter>	Allows you to view the details for or modify an option, or allows you to confirm your setting change and moves the cursor back to the option menu
<Esc>	Either moves your cursor back to the option menu without modifying an option, or opens the System Setup **Exit** screen

NOTE: For most of the options, any changes that you make are recorded but do not take effect until you restart the system.

Exiting the System Setup Program

If you have made no changes in the BIOS, the **Exit** screen displays the following options after you press <Esc> to exit the System Setup program:

- Remain in Setup
- Exit

If you have made changes in the BIOS, the **Exit** screen displays the following options after you press <Esc> to exit the System Setup program:

- Remain in Setup
- Save/Exit
- Discard/Exit

System Setup Options

Main Screen

Figure 2-1 shows an example of the main screen.

Figure 2-1. Main System Setup Program Screen

```
Dell System PowerEdge SC440                               (www.dell.com)
```

```
+--System                                 System Info
|   System Info
|   Processor Info        System              = Dell System PowerEdge SC440
|   Memory Info           BIOS version        = X06 (02/16/05)
|   PCI Info
|   Date/Time             Service Tag         = XXXXXXX
|   Boot Sequence         Express Service Code = XXXXXXX
+--Drives                 Asset Tag           = XXXXXXX
+--Onboard Devices
+--Performance            None of these fields are changeable.
+--Security
+--Power Management
+--Maintenance
+--POST Behavior



Press Up/Down arrows to select a different field
Press +/- keys to expand or collapse a group
Press ESC key to exit this program
```

Table 2-2 through Table 2-9 lists the options and descriptions for each group of information fields that appear on the main System Setup program screen.

📝 **NOTE:** The System Setup program defaults are listed under their respective options, where applicable.

Table 2-2. System Options

Option	Description
System Info	Displays the **System** name, **BIOS Version** number, **BIOS Date**, **Service Tag**, **Express Service Code**, and **Asset Tag**.
Processor Info	Displays the following information for the processor installed in the system: **Processor Type**, **Processor Clock Speed**, **Processor Bus Speed**, **Processor Cache Size**, **Processor ID** number, whether the processor is **Multiple Core Capable**, or **Hyperthreading Capable**, and if the processor has **64-bit Technology**.

Table 2-2. System Options *(continued)*

Option	Description
Memory Info	Displays the amount of **Installed Memory**, **Memory Speed**, **Memory Channel Mode**, and a description of the **Memory Technology**. This option also displays a table that describes the memory size, whether the memory module is ECC capable, single or dual rank, type, and organization for each DIMM socket.
PCI Info	Displays the types of cards that are installed in the PCI slots, if applicable.
Date/Time	Resets the system's internal calendar and clock.
Boot Sequence (**Diskette drive** default)	Determines the order in which the system searches for boot devices during system startup. Available options can include the diskette drive, CD drive, hard drives, and USB devices.

Table 2-3. Drive Options

Option	Description
Diskette Drive (**Internal** default)	Enables and disables the diskette drives and sets read permission for the internal diskette drive. **Off** disables all diskette drives. **USB** disables the internal diskette drive and enables a USB drive if the USB controller is enabled and a USB drive is connected. **Internal** enables the internal diskette drive. **Read Only** enables the internal drive controller and allows the internal diskette drive read-only permission. **NOTE:** Diskette drives are optional and may not be part of your system.
SATA0-3	Enables or disables a Serial Advanced Technology Attachment (SATA) device (such as hard drive, CD drive, or DVD drive). **Off** disables the interface so that the device cannot be used. **On** enables the interface so that the device can be used. Displays the **Controller** type, **Port** number the drive is using, **Drive ID** number, **Capacity**, whether the drive is controlled by the **BIOS**, and **Link Speed**.
PATA0-1	Enables or disables a Parallel Advanced Technology Attachment device (such as hard drive or IDE drive). **Off** disables the interface so that the device cannot be used. **On** enables the interface so that the device can be used. Displays the **Controller** type, **Port** number the drive is using, **Drive ID** number, **Capacity**, whether the drive is controlled by the **BIOS**, and **Link Speed**.
SMART Reporting (**Off** default)	Determines whether hard-drive errors for internal drives are reported during system startup. **Off** does not report errors. **On** reports errors.

Table 2-4. Onboard Devices Options

Option	Description
Integrated NIC (**On** default)	Enables or disables the integrated Network Interface Controller (NIC). **Off** disables the controller. **On** enables the controller. **On w/PXE** enables the controller with PXE. **On w/RPL** enables the controller with RPL. **NOTE:** PXE or RPL is required only if you are booting to an operating system on another system, not if you are booting to an operating system on a hard drive in this system.
USB Controller (**On** default)	Enables or disables the internal USB controller. **Off** disables the controller. **On** enables the controller. **No Boot** enables the controller, but disables the ability to boot from a USB device. **NOTE:** Operating systems with USB support will recognize USB storage devices regardless of the **No Boot** setting.
Front USB Ports (**On** default)	Enables or disables the front USB ports independently of the rear ports. **Off** disables the controller. **On** enables the controller. **No Boot** enables the controller, but disables the ability to boot from a USB device. **NOTE:** Operating systems with USB support will recognize USB storage devices regardless of the **No Boot** setting.
Serial Port #1 (**Auto** default)	**Serial Port 1** options are **COM1**, **COM3**, **Auto**, and **Off**. When serial port 1 is set to **Auto**, the integrated port automatically maps to the next available port. Serial port 1 attempts to use **COM1** first and then **COM3**. If both addresses are in use for a specific port, the port is disabled. When serial port is set to **COM1**, the integrated port is configured at 3F8h with IRQ4. When the serial port is set to **COM3**, the integrated port is configured at 3E8h with IRQ4. If you set the serial port to **Auto** and add an expansion card with a port configured to the same designation, the system automatically remaps the integrated port to the next available port designation that shares the same IRQ setting.

Table 2-5. Performance Options

Option	Description
Hyper-Threading (**On** default)	Determines whether the physical processor appears as one or two logical processors. The performance of some applications improve with additional logical processors installed. **On** enables hyperthreading. **Off** disables hyperthreading.
Multiple CPU Core (**On** default)	If the processor has multiple cores, specifies whether the processor will have one or two cores enabled. The performance of some applications will improve with the additional core. **Off** disables Multiple CPU Core Technology. **On** enables Multiple CPU Core Technology.

Table 2-5.   Performance Options *(continued)*

Option	Description
Limit CPUID	Limits the maximum value the processor standard CPUID function will support. Some operating systems will not complete installation when the maximum CPUID is greater than 3.
Speed Step (**Off** default)	If the processor supports Enhanced Speed Step Technology, specifies whether the option is **Off** or **On**. **NOTICE:** Before enabling the Speed Step option, ensure that the operating system also supports Enhanced Speed Step Technology. Enabling the feature on operating systems that do not support it may cause unpredictable results. See the operating system's documentation for its supported features.
HDD Acoustic Mode (**Performance** default)	Allows you to optimize IDE-drive performance and noise level based on personal preferences. **Bypass** is used for older drives. **Quiet** slows drive performance but reduces drive noise. **Suggested** adjusts performance to the manufacturers preferred mode. **Performance** increases drive performance but may increase drive noise.

Table 2-6.   Security Options

Option	Description
Unlock Setup	If the admin password has not been set, this option is not visible. If the admin password has been set, this option displays the current status of your system password. Temporarily unlock setup by entering your admin password.
Admin Password (**Not Set** default)	Displays the current status of your System Setup program's password security feature and allows you to verify and assign a new admin password. **NOTE:** See "Using the Admin Password" on page 37 for instructions on assigning a setup password and using or changing an existing setup password.
System Password (**Not Set** default)	Displays the current status of your system's password security feature and allows you to verify and assign a new system password. **NOTE:** See "Using the System Password" on page 35 for instructions on assigning a system password and using or changing an existing system password.
Password Changes (**Unlocked** default)	Determines the interaction between the **System** password and the **Admin** password. **Locked** prevents a user with a valid **System** password from being able to modify the **System** password. **Unlocked** allows a user with a valid **System** password to modify the **System** password.

Table 2-6. **Security Options** *(continued)*

Option	Description
Chassis Intrusion (**On-Silent** default)	Enables or disables the chassis-intrusion detection feature. When set to **On-Silent**, chassis intrusion is detected but no warning message is reported during start-up. When set to **On**, this field displays **DETECTED** when the chassis cover has been opened. Pressing any edit key acknowledges the intrusion and arms the system to look for further security breaches. **Off** disables the chassis-intrusion detection feature.
Intrusion Alert	If an intrusion has been detected, press the <Enter> key to acknowledge the intrusion and arm the system to look for further security breaches.
Execute Disable (**On** default)	Specifies whether or not Execute Disable Memory Protection Technology is **On** or **Off**.

Table 2-7. **Power Management Options**

Option	Description
AC Recovery (**Last** default)	Determines how the system responds when AC power is re-applied after a power loss. **Off** commands the system to stay off when the power is re-applied. You must press the front-panel power button before the system turns on. **On** commands the system to turn on when the power is re-applied. **Last** commands the system to return to the last power state the system was in just before it was turned off.
Auto Power On (**Off** default)	Determines when to use the **Auto Power Time** setting to turn on the system. **Off** commands the system to not use the **Auto Power Time** feature. **Everyday** turns on the system every day at the time set in **Auto Power Time**. **Weekdays** turns on the system every day from Monday through Friday at the time set in **Auto Power Time**.
Auto Power Time	Determines the time that you want the system to turn on.
Low Power Mode (**Off** default)	**On** conserves more power by removing power from most hardware features. **Off** conserves less power and removes power from fewer hardware features. **NOTE:** With this option set to **On**, the integrated NIC will be disabled when the system is in the **Hibernate** or **Off** states. Only add-in NICs will be able to wake the system remotely.
Remote Wake Up (**Off** default)	Determines how the system is turned on remotely from the **Suspend**, **Hibernate**, or **Off** states. **Off** disables the NIC from waking up the system. **On** enables the NIC to wake up the system. **On w/ Boot to NIC** enables the NIC to wake up the system and boot from the network. **NOTE:** If you want the system to perform a **Remote Wake Up**, you must first set **Low Power Mode** to **Off**.

Table 2-8.   Maintenance Options

Option	Description
Service Tag	Displays the system service tag. If the service tag is corrupted, the system will prompt to enter the correct service tag upon entering the system setup program.
SERR Message	Controls the SERR message mechanism. By default, this feature is **On**. **NOTE:** Some graphics cards require that the SERR message mechanism be disabled.
Load Defaults	Allows you to restore all System Setup options to their factory defaults.
Event Log	Allows you to view the **Event Log**. Entries are marked **R** for **Read** and **U** for **Unread**. **Mark All Entries Read** puts an R to the left of all the entries. **Clear Log** clears the **Event Log**.

Table 2-9.   POST Behavior Options

Option	Description
Fast Boot (**On** default)	When enabled, this feature reduces system startup time by bypassing some compatibility steps. **Off** does not skip any steps during system startup. **On** starts the system more quickly.
Numlock Key (**On** default)	Determines the functionality of the numeric keys on the right side of your keyboard. **Off** commands the right keypad keys to function as arrows. **On** commands the right keypad keys to function as numbers.
POST Hotkeys (**Setup and Boot Menu** default)	Determines whether the sign-on screen displays a message stating the keystroke sequence that is required to enter the **Setup** program or the **Quickboot** feature. **Setup & Boot Menu** displays both messages (F2=Setup and F11=Boot Menu). **Setup** displays the setup message only (F2=Setup). **Boot Menu** displays the **Quickboot** message only (F11=Boot Menu). **None** displays no message.
Keyboard Errors (**Report** default)	When set to **Report** (enabled) and an error is detected during POST, the BIOS will display the error message and prompt you to press <F1> to continue or press <F2> to enter System Setup. When set to **Do Not Report** (disabled) and an error is detected during POST, the BIOS will display the error message and continue booting the system. **NOTE:** When detected, some errors (such as CPU or PCI fan failure) will display an error message and prompt you to press <F1> to continue, or <F2> to enter the **Setup Menu**.

Password Features

⊘ **NOTICE:** The password features provide a basic level of security for the data on your system. If your data requires more security, use additional forms of protection, such as data encryption programs.

⊘ **NOTICE:** Anyone can access the data stored on your system if you leave the system running and unattended without having a system password assigned or if you leave your system unlocked so that someone can disable the password by changing a jumper setting.

Your system is shipped to you without the system password feature enabled. If system security is a concern, operate your system only with system password protection.

To change or delete an existing password, you must know the password (see "Deleting an Existing System Password" on page 36). If you forget your password, you cannot operate your system or change settings in the System Setup program until a trained service technician changes the password jumper setting to disable the passwords, and erases the existing passwords. This procedure is described in "Disabling a Forgotten Password" on page 104.

Using the System Password

After a system password is assigned, only those who know the password have full use of the system. When the **System Password** option is **Set**, the system prompts you for the system password after the system starts.

📝 **NOTE:** If you have assigned an admin password (see "Using the Admin Password" on page 37), the system accepts your admin password as an alternate system password.

Assigning a System Password

Before you assign a system password, enter the System Setup program and check the **System Password** option.

When a system password is assigned, the setting shown for the **System Password** option is **Set**. If the setting shown for the **Password Changes** is **Unlocked**, you can change the system password. If the **Password Changes** option is **Locked**, you cannot change the system password. When the system password feature is disabled by a jumper setting, the system password is **Disabled**, and you cannot change or enter a new system password.

When a system password is not assigned and the password jumper on the system board is in the enabled (default) position, the setting shown for the **System Password** option is **Not Set** and the **Password Changes** field is **Unlocked**. To assign a system password:

1 Verify that the **Password Changes** option is set to **Unlocked**.

2 Highlight the **System Password** option and press <Enter>.

3 Type your new system password.

   You can use up to 32 characters in your password.

   As you press each character key (or the spacebar for a blank space), a placeholder appears in the field.

The password assignment is not case-sensitive. However, certain key combinations are not valid. If you enter one of these combinations, the system beeps. To erase a character when entering your password, press <Backspace> or the left-arrow key.

> ![note icon] **NOTE:** To escape from the field without assigning a system password, press <Esc> at any time prior to completing step 5.

4 Press <Enter>.

5 To confirm your password, type it a second time and press <Enter>.

6 Press <Enter> again to continue.

The setting shown for the **System Password** changes to **Set**.

7 Save and exit the System Setup program and begin using your system.

Using Your System Password to Secure Your System

> ![note icon] **NOTE:** If you have assigned an admin password (see "Using the Admin Password" on page 37), the system accepts your admin password as an alternate system password.

When the **Password Status** option is set to **Unlocked**, you have the option to leave the password security enabled or to disable the password security.

To leave the password security enabled:

1 Turn on or reboot your system by pressing <Ctrl><Alt><Del>.

2 Type your password and press <Enter>.

When the **Password Status** option is set to **Locked** when you turn on or reboot your system, type your password and press <Enter> at the prompt.

After you type the correct system password and press <Enter>, your system operates as usual.

If an incorrect system password is entered, the system displays a message and prompts you to re-enter your password. You have three attempts to enter the correct password. After the third unsuccessful attempt, the system displays an error message showing the number of unsuccessful attempts and that the system has halted. You are prompted to shut down your system. This message can alert you to an unauthorized person attempting to use your system.

Even after you shut down and restart the system, the error message continues to be displayed until the correct password is entered.

> ![note icon] **NOTE:** You can use the Password Changes option in conjunction with the System Password and Admin Password options to further protect your system from unauthorized changes.

Deleting an Existing System Password

1 Enter the System Setup program.

2 Highlight the **System Password** option, and press <Enter> to access the system password window.

3 Enter the old password, and press <Enter>.

4 Press <Enter> twice to enter a new blank password and to confirm the new blank password.

5 Press <Enter> again to continue.

The setting changes to **Not Set**.

Changing an Existing System Password

1 Enter the System Setup program.

2 Highlight the **System Password** option, and press <Enter> to access the system password window.

3 Enter the old password, and press <Enter>.

4 Enter a new password, and press <Enter>.

5 Enter the new password again to confirm the change, and press <Enter>.

6 Press <Enter> to continue.

The setting remains **Set**.

Using the Admin Password

Assigning an Admin Password

You can assign (or change) an admin password only when the **Admin Password** option selected is **Not Set**. To assign an admin password:

1 Highlight the **Admin Password** option and press <Enter>.

2 Type your new admin password.

You can use up to 32 characters in your password.

As you press each character key (or the spacebar for a blank space), a placeholder appears in the field.

The password assignment is not case-sensitive. However, certain key combinations are not valid. If you enter one of these combinations, the system beeps. To erase a character when entering your password, press <Backspace> or the left-arrow key.

NOTE: To escape from the field without assigning a system password, press <Enter> to move to another field, or press <Esc> at any time prior to completing step 5.

3 Press <Enter>.

4 To confirm your password, type it a second time and press <Enter>.

The setting shown for the **Admin Password** changes to **Set**.

5 Save and exit the System Setup program and begin using your system.

The next time you enter the System Setup program, the system prompts you for the admin password.

A change to the **Admin Password** option becomes effective immediately (restarting the system is not required). By entering the **System Password**, you can scroll through and view all the screens, but you cannot make changes to the settings for which a lock graphic is displayed in the upper right corner of the option window.

Operating With an Admin Password Set

If **Admin Password** is **Set**, you must enter the correct admin password before you can modify most of the System Setup options. When you start the System Setup program, the program prompts you to enter a password.

If you do not enter the correct password in three attempts, the system lets you view, but not modify, the System Setup screens—with the following exception: if **System Password** is not **Set** and is not locked through the **Password Changes** option, you can assign a system password (however, you cannot disable or change an existing system password).

> **NOTE:** You can use the **Password Changes** option in conjunction with the **Admin Password** option to protect the system password from unauthorized changes.

Deleting an Existing Admin Password

1 Enter the System Setup program.

2 Highlight the **Admin Password** option, and press <Enter> to access the admin password window.

3 Enter the old password, and press <Enter>.

4 Press <Enter> twice to enter a new blank password and to confirm the new blank password.

5 Press <Enter> again to continue.

   The setting changes to **Not Set**.

Changing an Existing Admin Password

1 Enter the System Setup program.

2 Highlight the **Admin Password** option, and press <Enter> to access the admin password window.

3 Enter the old password, and press <Enter>.

4 Enter a new password, and press <Enter>.

5 Enter the new password again to confirm the change, and press <Enter>.

6 Press <Enter> to continue.

   The setting remains **Set**.

Disabling a Forgotten Password

See "Disabling a Forgotten Password" on page 104.

3

Installing System Components

This section describes how to install the following system components:

- Front drive bezel
- Diskette drive
- Optical and tape drives
- Hard drives
- Expansion cards
- SAS controller card
- Memory
- Microprocessor
- Cooling fans
- System battery
- Power supply
- Chassis intrusion switch
- Bezel
- I/O panel
- System board

Recommended Tools

You may need the following items to perform the procedures in this section:

- #2 Phillips screwdriver
- Wrist grounding strap

Inside the System

In Figure 3-1, the system cover is opened to provide an interior view of the system.

Figure 3-1. Inside the System
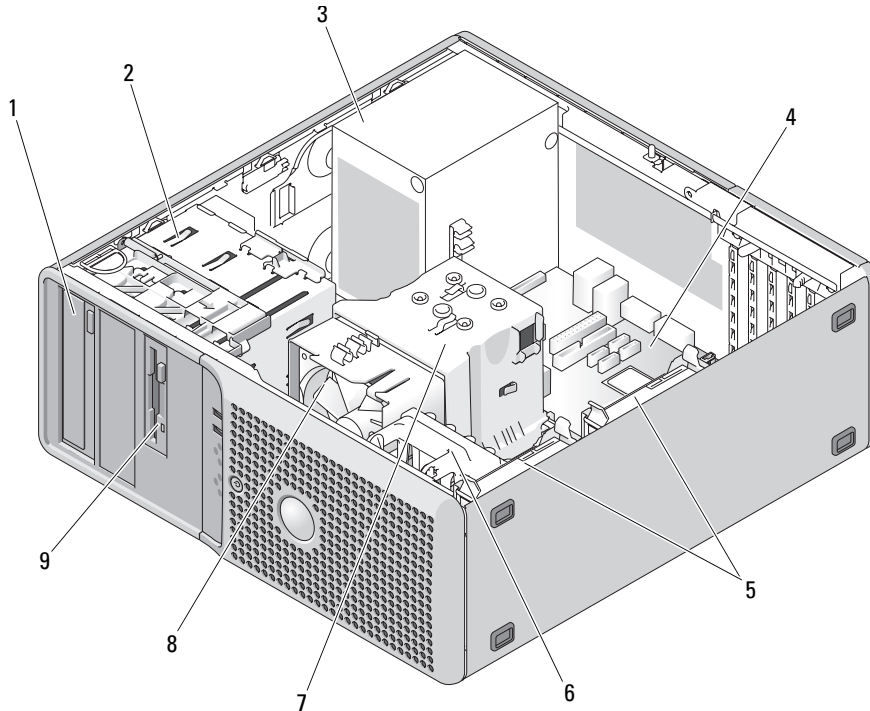
1	5.25-inch drive bays (2)	2	drive cage	3	power supply
4	system board	5	hard drives (2)	6	card cage fan
7	heatsink and shroud assembly	8	processor cooling fan	9	3.5-inch drive bay

The system board can accommodate one processor, five expansion cards, and four memory modules. The hard drive bays provide space for up to two SAS or SATA hard drives. Drive bays in the front of the system provide space for an optical drive, an optional tape drive or second optical drive, and an optional diskette drive. A controller expansion card is required for SAS hard drives. Power is supplied to the system board and internal peripherals through a single nonredundant power supply.

Opening the System

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Press the power button to ground the system board.

3 If you have installed a padlock through the padlock ring on the back panel, remove the padlock.

4 Lay the system on its side as shown in Figure 3-2.

5 Open the system by sliding the cover release tab toward the rear of the system and lifting the cover off. See Figure 3-2.

Closing the System

1 Ensure that all internal cables are connected and folded out of the way.

2 Ensure that no tools or extra parts are left inside the system.

3 Reinstall the system cover:

   a Insert the bottom edge of the cover into the bottom of the system chassis. See Figure 3-2.

   b Press down on the cover until the cover release tab snaps into place.

4 If applicable, install the padlock.

5 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

   After you open and close the cover, the chassis intrusion detector, if enabled, causes the following message to appear on the screen at the next system start-up:

   `ALERT! Cover was previously removed.`

6 To reset the chassis intrusion detector, press <F2> to enter the System Setup program. See "Using the System Setup Program" on page 27.

   📝 **NOTE:** If a setup password has been assigned by someone else, contact your network administrator for information on resetting the chassis intrusion detector.

Figure 3-2. Opening and Closing the System

1   release tab
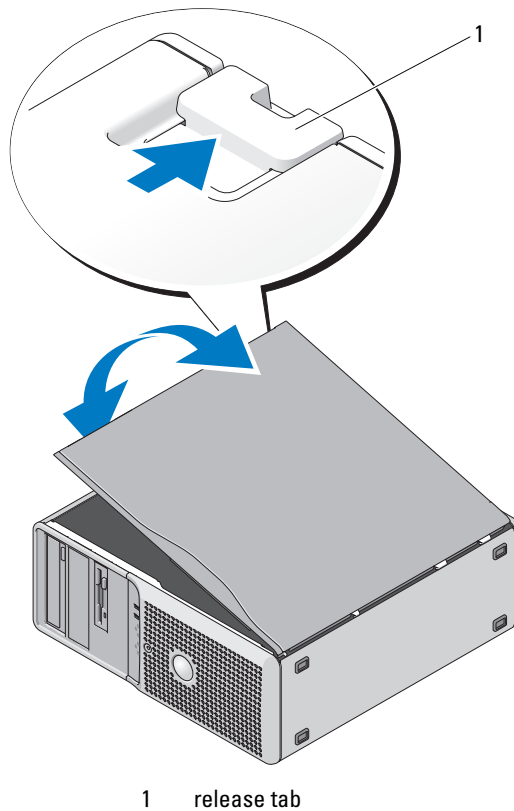
Front Drive Bezel

The front drive bezel is the cover for the optional diskette and 5.25-inch drives. To remove or install a drive, you must first remove the front drive bezel.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

Removing the Front Drive Bezel

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

✍ **NOTE:** The sliding plate secures and releases the front drive bezel and helps to secure the drives.

3 Slide the lever on the sliding plate in the direction of the arrow until it releases the front drive bezel from its side hinges. See Figure 3-3.

4 Carefully tilt the front drive bezel away from the chassis and lift it out as shown in Figure 3-3.

5 Close the system. See "Closing the System" on page 41.

Replacing the Front Drive Bezel

1 Slide the lever on the sliding plate in the direction of the arrow and fit the bezel into the chassis.

2 Snap the bezel into place and release the lever.

Figure 3-3.   Removing and Replacing the Front Drive Bezel

| 1 | front drive bezel | 2 | sliding plate | 3 | arrow on the sliding plate |
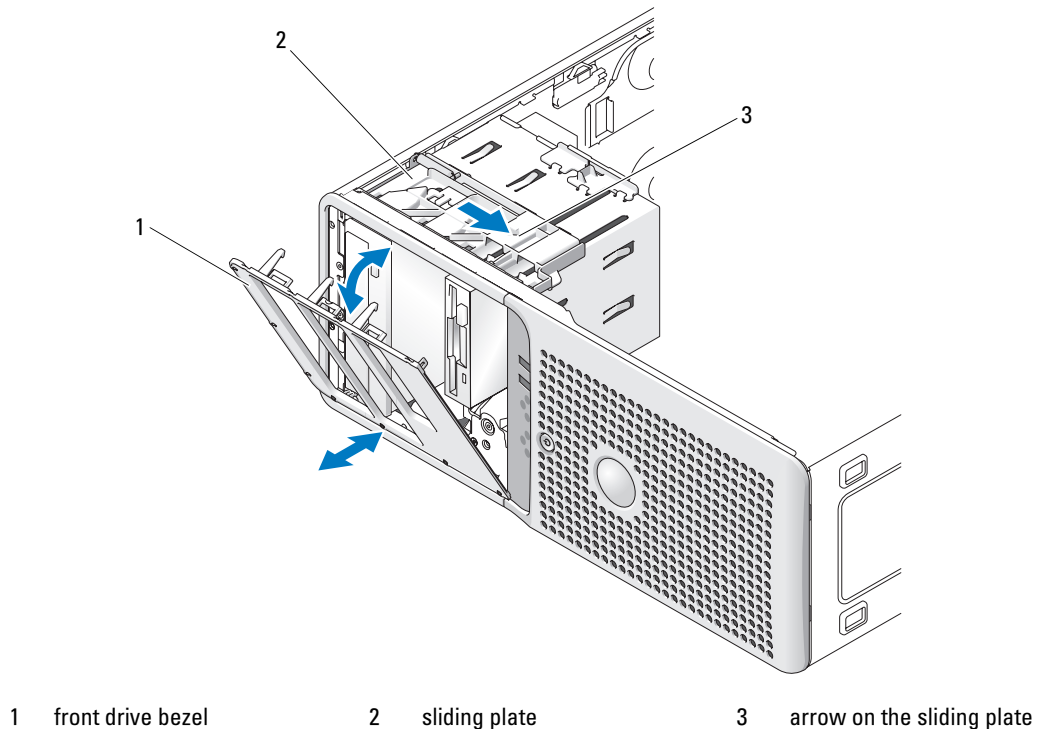
Removing an Insert on the Front Drive Bezel

If you install a drive in the 3.5-inch or 5.25-inch drive bays, first remove the corresponding insert on the front drive bezel. From the back of the bezel, squeeze the tabs on the end of the insert and rotate the insert away from the bezel. See Figure 3-4.

Replacing an Insert on the Front Drive Bezel

If you remove a drive in the 3.5-inch or 5.25-inch drive bays, replace the corresponding insert on the front drive bezel. From the back of the bezel, fit the tab on the end of the insert into the notch on the bezel and snap the other end of the insert into place. See Figure 3-4.

Figure 3-4.   Removing and Replacing the Front Drive Bezel Insert

1	front drive bezel	2	insert tabs	3	drive bezel insert
4	screws for an optional 5.25-inch drive (3)				
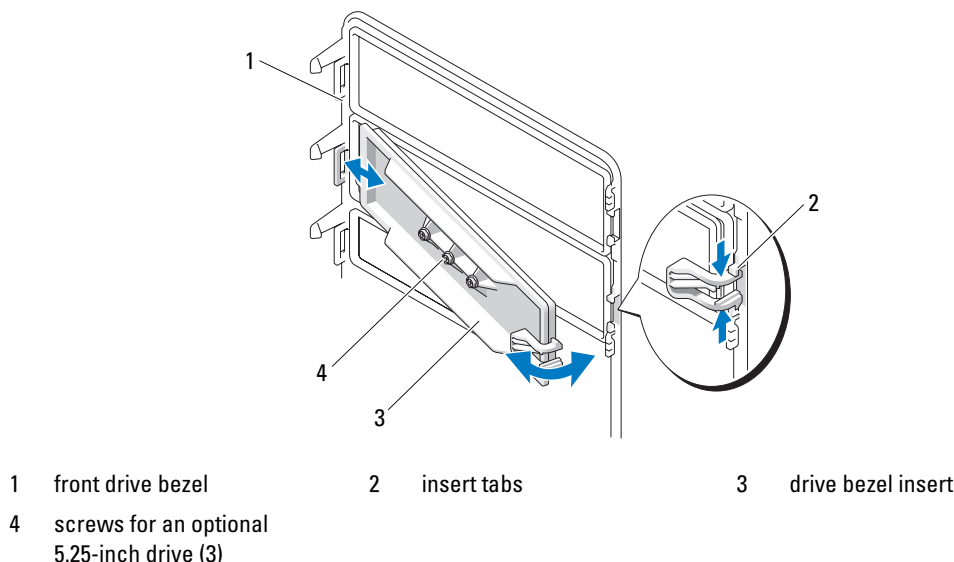
Diskette Drive

The 3.5-inch drive bay supports an optional standard diskette drive.

Removing the Diskette Drive

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1   Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2   Open the system. See "Opening the System" on page 41.

3   Remove the front drive bezel. See "Removing the Front Drive Bezel" on page 42.

4   Disconnect the power and data cables from the diskette drive. See Figure 3-5.

5   Slide the lever on the sliding plate in the direction of the arrow. See Figure 3-5.

6   Hold the lever in position and slowly pull the drive out of the bay.

Figure 3-5. Removing or Installing a Diskette Drive
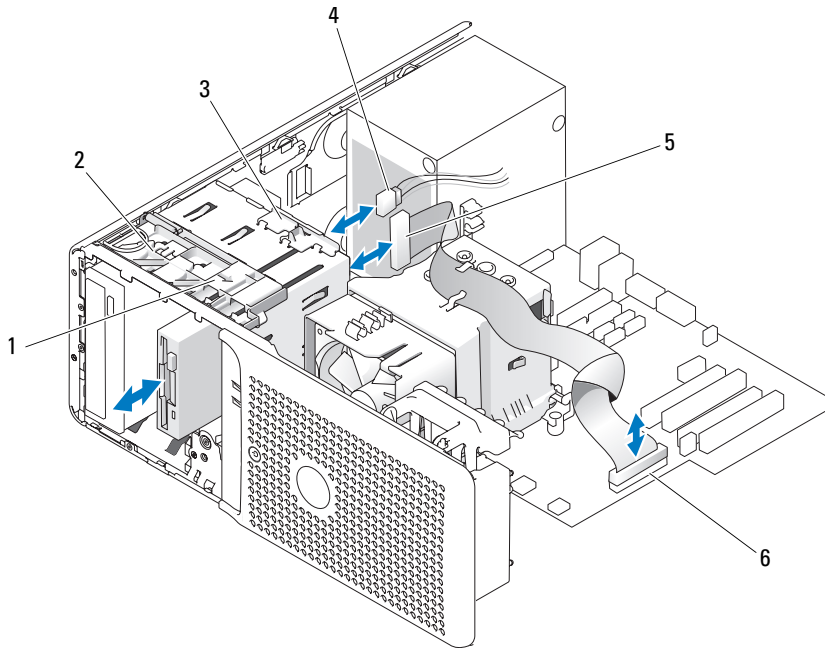
1	arrow on the sliding plate	2	sliding plate	3	drive-stop tab
4	power cable to diskette drive (P7)	5	data cable to diskette drive	6	data cable to system board connector (FLOPPY)

7 If you are permanently removing the drive, replace the 3.5-inch insert on front drive bezel. See "Replacing an Insert on the Front Drive Bezel" on page 44.

   If you are replacing the diskette drive, see "Installing a Diskette Drive" on page 45.

8 Replace the front drive bezel. See "Replacing the Front Drive Bezel" on page 43.

9 Close the system. See "Closing the System" on page 41.

10 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

Installing a Diskette Drive

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Unpack the replacement diskette drive, and prepare it for installation.

4 Check the documentation for the drive to verify that it is configured for your system.

5 Remove the front drive bezel. See "Removing the Front Drive Bezel" on page 42.

6 Remove the 3.5-inch insert on the front drive bezel. See "Removing an Insert on the Front Drive Bezel" on page 43.

7 Remove the four shoulder screws from the back of the insert. See Figure 3-4; the 3.5-inch insert holds four screws.

8 Attach the four screws to the diskette drive as shown in Figure 3-6.

Figure 3-6. Installing Diskette Drive Shoulder Screws

1   screws (4)
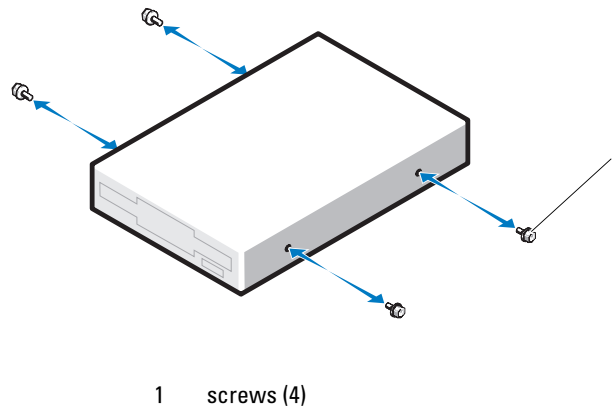
9 Verify that the drive-stop tab on the drive cage is in the proper position. It should be in its lowermost position so that the diskette icon on the drive cage is visible. See Figure 3-5.

NOTE: Inserting a diskette drive into the drive bay with the drive-stop tab in the improper position will cause the drive to be positioned too deep in the bay.

10 From the front of the chassis, slide the drive into the drive bay until the shoulder screws snap securely into the sliding plate.

11 Connect the P7 power cable to the drive. See Figure 3-5.

12 Connect the data cable from the drive to the diskette drive connector (FLOPPY) on the system board. See Figure 3-5 and Figure 6-2.

13 Replace the front drive bezel. See "Replacing the Front Drive Bezel" on page 43.

14 Close the system. See "Closing the System" on page 41.

15 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

16 Enter the System Setup program and ensure that the drive's controller is enabled. See "Using the System Setup Program" on page 27.

17 (Optional) Test the drive by running the system diagnostics. See "Running the System Diagnostics" on page 97.

Optical and Tape Drives

In the upper 5.25-inch drive bay, you can install only an optical drive. In the lower 5.25-inch drive bay, you can install either an optical or a tape backup unit.

Removing an Optical or Tape Drive

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Remove the front drive bezel. See "Removing the Front Drive Bezel" on page 42.

4 Disconnect the power and data cables from the back of the drive. See Figure 3-7.

5 Slide the lever on the sliding plate in the direction of the arrow to release the shoulder screw.

6 Slide the drive out to remove it from the drive bay.

Figure 3-7.   Removing and Installing an Optical or Tape Drive
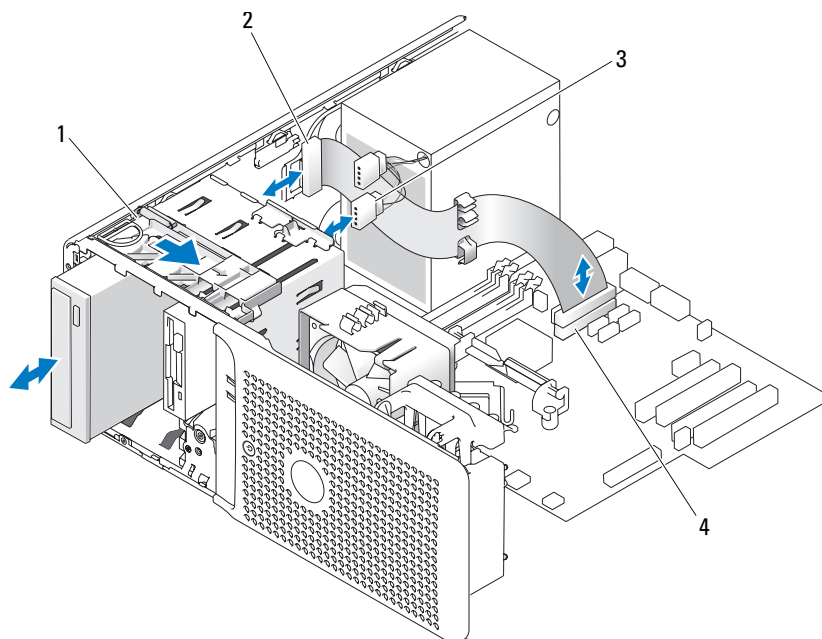
1	sliding plate	2	IDE data cable to drive	3	power cable to drive
4	IDE connector on system board				

7 If you are installing another drive in the bay, see "Installing an Optical or Tape Drive" on page 49.

8 If the drive is being permanently removed, install an insert on front drive bezel. See "Replacing an Insert on the Front Drive Bezel" on page 44.

9 Replace the front drive bezel. See "Replacing the Front Drive Bezel" on page 43.

10 Close the system. See "Closing the System" on page 41.

11 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

Installing an Optical or Tape Drive

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Unpack the drive and prepare it for installation. For instructions, see the documentation that accompanied the drive.

   If you are installing a SCSI tape drive, you must have a SCSI controller card installed (see "Installing an Expansion Card" on page 57) and configure the tape drive according to the documentation that came with the tape drive, based on the following guidelines:

   a Each device attached to a SCSI host adapter must have a unique SCSI ID number (narrow SCSI devices use IDs 0 to 7; wide SCSI devices use IDs from 0 to 15). Set the drive's SCSI ID to avoid conflicts with other devices on the SCSI bus. For the default SCSI ID setting, see the documentation provided with the drive.

   📝 **NOTE:** There is no requirement that SCSI ID numbers be assigned sequentially or that devices be attached to the cable in order by ID number.

   b SCSI logic requires that the two devices at opposite ends of a SCSI chain be terminated and that all devices in between be unterminated. Therefore, you enable the tape drive's termination if it is the last device in a chain of devices (or sole device) connected to the SCSI controller.

2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system. See "Opening the System" on page 41.

4 Remove the front drive bezel. See "Removing the Front Drive Bezel" on page 42.

5 If another drive is installed, remove it (see "Removing an Optical or Tape Drive" on page 47) and remove the three shoulder screws to attach to the new drive (see Figure 3-8).

6 If the drive bay is empty, remove the insert on the front drive bezel. See "Removing an Insert on the Front Drive Bezel" on page 43.

7 Remove the three shoulder screws from the insert, and attach them to the bottom row of holes on the drive. See Figure 3-8.

Figure 3-8.   Installing Optical or Tape Drive Shoulder Screws

1   screws (3)
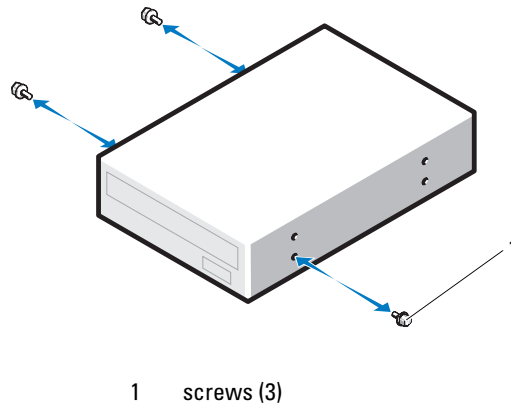
8   Gently slide the drive into place until you hear a click or feel the drive securely installed.

9   Attach the power cable to the drive. See Figure 3-7.

10   Attach the data cable:

   • If you are installing an IDE drive, another drive may be attached to the same data cable by another connector. Connect the data cable to the IDE connector on the system board. See Figure 3-7.

   • If you are installing a SCSI tape drive, connect the SCSI interface cable in the drive kit from the SCSI controller card to the drive.

11   Check all cable connections, and fold cables out of the way to allow for airflow between the fan and cooling vents.

12   Replace the front drive bezel. See "Replacing the Front Drive Bezel" on page 43.

13   Close the system. See "Closing the System" on page 41.

14   Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

15   If you installed an IDE drive, enter the System Setup program and ensure that the drive's IDE controller is enabled. See "Using the System Setup Program" on page 27.

16   (Optional) Test the drive by running the system diagnostics. See "Running the System Diagnostics" on page 97.

Hard Drives

📝 **NOTE:** The system's drive configuration must consist of all SATA hard drives or all SAS hard drives.

Hard Drive Installation Guidelines

Your system contains up to two SATA or SAS hard drives in internal drive bays. Both drives must be either SAS or SATA; mixed configurations are not supported. Up to two SATA drives may be connected to the system's integrated SATA controller or to an optional SAS controller expansion card. Up to two SAS drives may be connected to an optional SAS controller expansion card. Table 3-1 describes the possible drive configurations.

Table 3-1. Hard-Drive Configurations

| Drive Number	Drive Type	Location	Controller	Connector
1	SATA	HDD0	integrated SATA controller	SATA0
			SAS expansion card (slot 2)	HDD0
1	SAS	HDD0	SAS expansion card (slot 2)	HDD0
2	SATA	HDD1	integrated SATA	SATA2
			SAS expansion card (slot 2)	HDD1
2	SAS	HDD1	SAS expansion card (slot 2)	HDD1

Removing a Hard Drive

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Disconnect the hard drive power cable from the hard drive that you are removing.

4 Disconnect the blue data cable from the hard drive that you are removing by pulling up on the blue tab.

5 Press the blue tabs on each side of the hard-drive bracket toward each other and slide the drive up and out of the bay. See Figure 3-9.

Figure 3-9. Removing and Installing a Hard Drive in the Drive Carrier
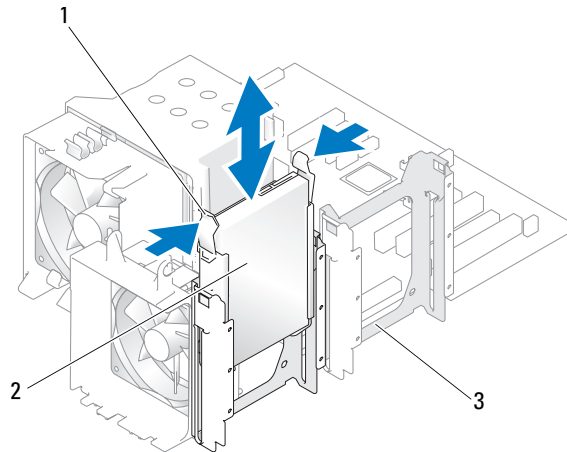
| 1 | blue tabs (2) | 2 | hard drive in primary hard drive bay | 3 | secondary hard drive bay |

✎ **NOTE:** If you do not intend to replace the drive, it is highly recommended that you remove the drive from the guide bracket (see Figure 3-10) and insert the empty guide bracket back into the drive bay. This eliminates the likelihood that the empty bracket will be misplaced or improperly stored while not in use.

6 Close the system. See "Closing the System" on page 41.

7 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

Installing a Hard Drive

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Unpack the replacement hard drive and prepare it for installation.

2 Check the documentation for the hard drive to verify that the drive is configured for your system.

3 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

4 Open the system. See "Opening the System" on page 41.

5 If you are replacing a hard drive, remove the drive that you are replacing (see "Removing a Hard Drive" on page 51).

If there is a hard-drive bracket in the empty hard-drive bay, remove the bracket by pressing the two tabs toward each other and pulling it up and out of the drive bay.

If a replacement hard drive does not have the hard-drive bracket attached, remove the bracket from the old drive.

6 Snap the new drive into the guide bracket. See Figure 3-10.

7 Insert the guide bracket assembly into the drive bay until it snaps into place. See Figure 3-9.

Figure 3-10. Installing a Hard Drive in a Drive Bracket
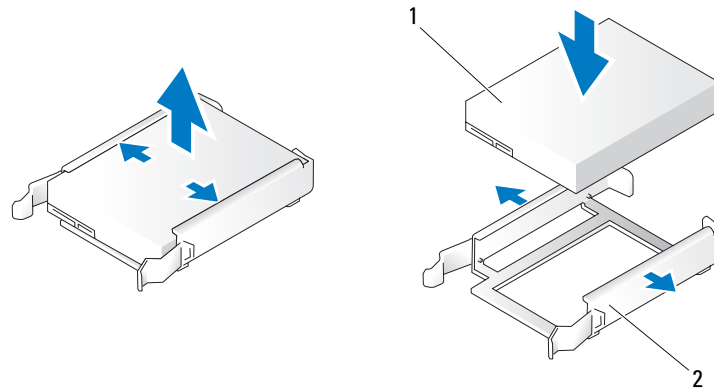
1	hard drive	2	hard drive bracket

NOTICE: SAS drives and SATA drives cannot be mixed in the system. The drives must be either SATA or SAS hard drives.

NOTE: The SAS controller card must be installed in PCIe SLOT2. See Figure 6-2.

8 Connect the power cable to the hard drive.

9 Connect the data cable to the hard drive:

- For connection to the integrated SATA controller (SATA hard drives only), connect the SATA data cable to the SATA0 (first drive) and SATA2 (second drive) connectors on the system board. See Figure 3-11. See Figure 6-2 for the location of the hard drive connectors on the system board.

- For connection to a SAS controller expansion card (SAS or SATA hard drives), connect the data cable from the SAS controller card and the power cable as shown in Figure 3-12. See "SAS Controller Expansion Card" on page 58 for instructions about installing the card and routing the cables.

Figure 3-11. Cabling a SATA Hard Drive to the Integrated SATA Controller
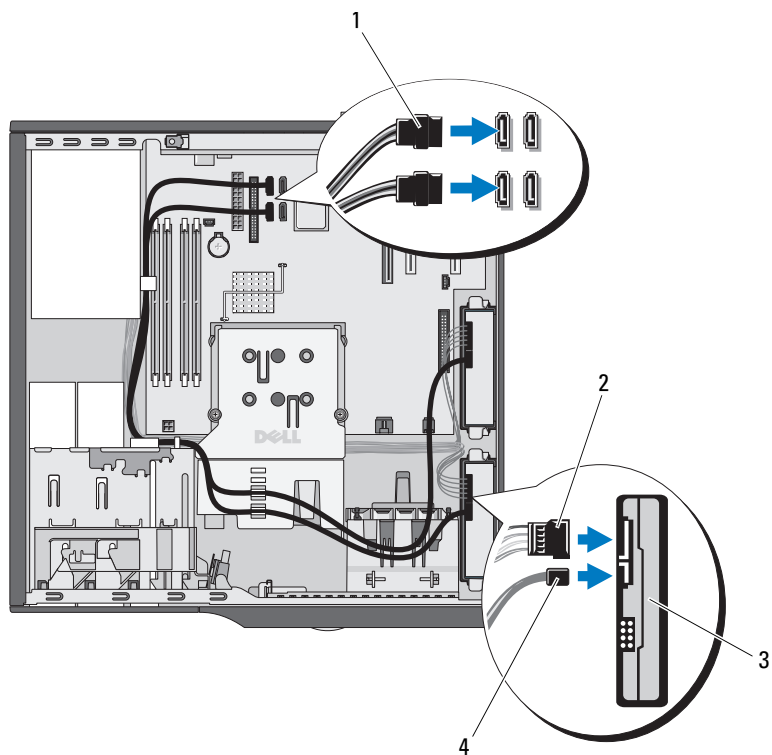
1	SATA data cable to system board	2	power cable to hard drive	3	SATA hard drives (2)
4	SATA data cable to hard drive				

Figure 3-12. Cabling a SAS or SATA Hard Drive to a SAS Controller Expansion Card
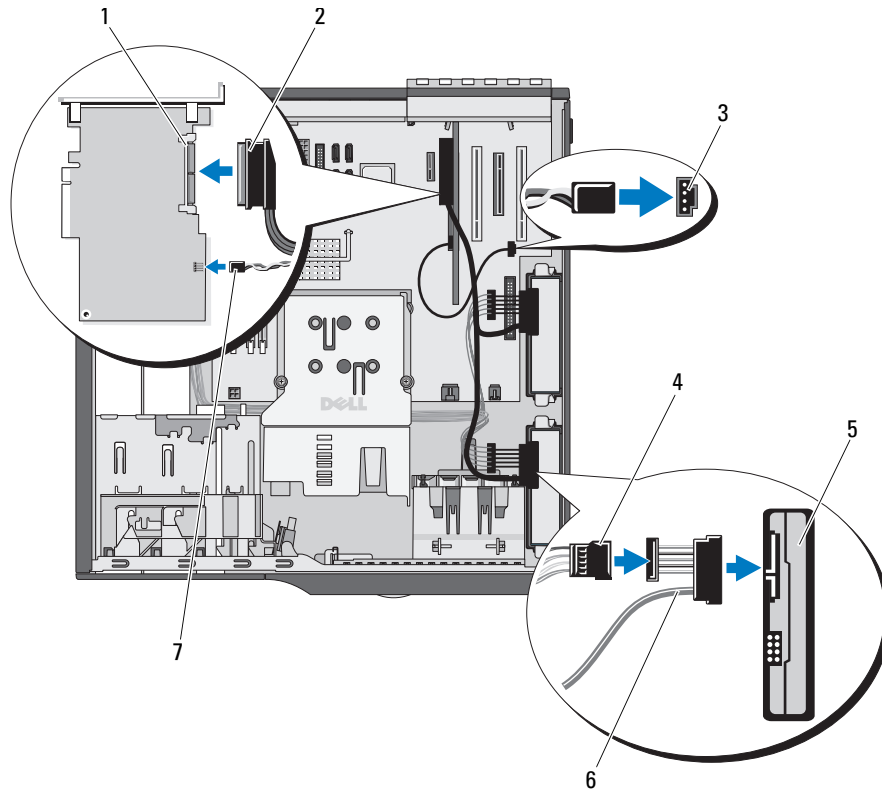
1	SAS controller card	2	data cable to SAS controller card	3	AUX_LED connector
4	power cable to hard drive	5	SAS or SATA hard drives (2)	6	data cable to hard drive
7	hard drive activity indicator cable to SAS controller card				

10 Ensure that all connectors are properly cabled and firmly seated.

11 Close the system. See "Closing the System" on page 41.

12 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

See the documentation that came with the drive for instructions on installing any software required for drive operation.

13 Press <F2> to enter the System Setup program (see "Entering the System Setup Program" on page 27), and ensure that the drive's controller is enabled.

14 Exit the System Setup program and reboot the system.

15 Partition and logically format the drive.

See the documentation for your operating system for instructions.

16 (Optional) Test the hard drive by running the system diagnostics. See "Running the System Diagnostics" on page 97.

17 If the drive you just installed is the primary drive, install your operating system on the hard drive.

Expansion Cards

The system board can accommodate up to five expansion cards:

- two 5-V, half-length 32-bit, 33-MHz PCI (slots 3 and 5)
- one 2.5-Gb/sec PCIe x1 (slot 1)
- one 2.5-Gb/sec PCIe x4 (slot 4)
- one 2.5-Gb/sec PCIe x8 (slot 2)

See Figure 6-2 for the location of the expansion card slots.

🖉 **NOTE:** The size of the expansion card connectors for the PCI x4 card is PCIx 8, and for the PCI x8 card is PCI x16.

Removing an Expansion Card

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 To open the card retention door, press the two release tabs inward. See Figure 3-13.

4 If necessary, disconnect any cables from the card.

5 Grasp the card by its top corners and ease it out of its connector.

6 If you are removing the card permanently, install a filler bracket in the empty card slot.

🖉 **NOTE:** Filler brackets must be installed over empty expansion card slots to maintain Federal Communications Commission (FCC) certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

Figure 3-13. Removing and Installing an Expansion Card
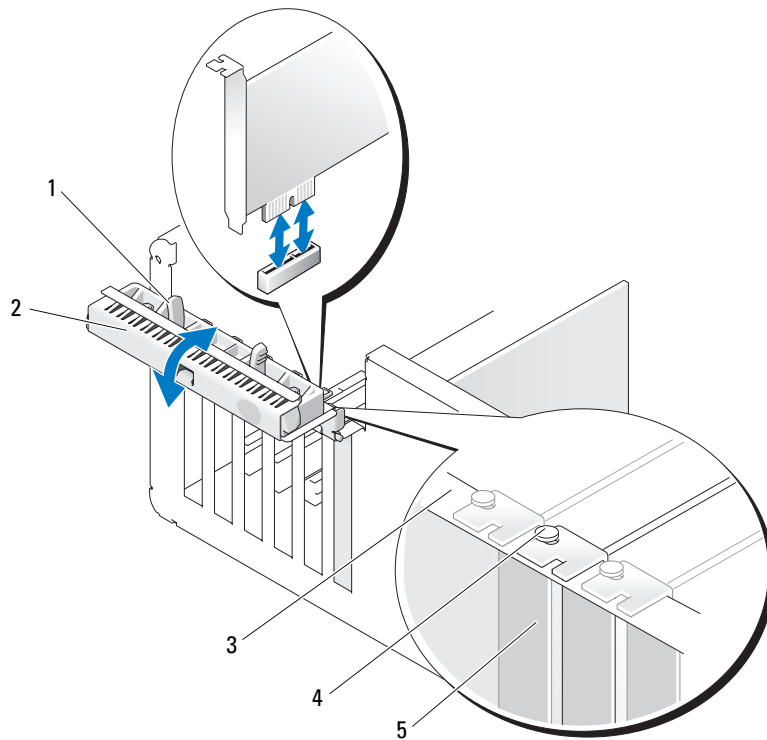
1	release tabs (2)	2	card retention door	3	alignment bar
4	alignment guide	5	filler bracket			

 7 Close the card retention door to secure the remaining card(s) in the system. See Figure 3-13.

 8 Close the system. See "Closing the System" on page 41.

 9 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

 10 Remove the card's device driver from the operating system.

Installing an Expansion Card

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your _Product Information Guide_ for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

 2 Open the system. See "Opening the System" on page 41.

3 To open the card retention door, press the two release tabs inward. See Figure 3-13.

4 If you are installing a new card, remove the filler bracket.

> ✐ **NOTE:** Keep this bracket in case you need to remove the expansion card. Filler brackets must be installed over empty expansion-card slots to maintain FCC certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

5 Prepare the card for installation.

See the documentation that came with the card for information on configuring the card, making internal connections, or otherwise customizing it for your system.

> ✐ **NOTE:** Some NICs automatically start the system when they are connected to a network.

6 Insert the card into the expansion card connector on the system board (SLOT1, SLOT2, SLOT3, SLOT4, or SLOT5) and press down firmly. Ensure that the card is fully seated in the slot and all cards and filler brackets are flush with the alignment bar. See Figure 6-2 for the location of the five expansion card connectors.

7 Close the card retention door to secure the card(s) in the system.

> ⊘ **NOTICE:** Do not route card cables over or behind the cards. Cables routed over the cards can prevent the system cover from closing properly or cause damage to the equipment.

8 Connect any cables that should be attached to the card.

See the documentation for the card for information about the card's cable connections.

9 Close the system. See "Closing the System" on page 41.

10 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

11 Install any device drivers required for the card as described in the documentation for the card.

SAS Controller Expansion Card

Read the installation instructions in the documentation for your SAS controller card. Install the card in expansion card connector SLOT2 (see "Installing an Expansion Card" on page 57), and connect the hard-drive activity indicator cable from the card to the AUX_LED connector on the system board (see Figure 6-2 for the connector location). See "Hard Drives" on page 51 for information about connecting hard drives.

Memory

The four memory module connectors on the system board can accommodate from 512 MB to 4 GB of 533-MHz and 667-MHz unbuffered ECC DDR II single or dual-rank memory modules. See Figure 6-2 for the location of the four memory module connectors.

> ✐ **NOTE:** As shown in Figure 6-2, memory slots are not in numeric order on the system board. When installing memory, take care to install it in the proper slots according to the configuration guidelines in Table 3-2. Installing memory in the wrong slots will significantly reduce system performance.

Memory Module Upgrade Kits

The system is upgradable to 4 GB by installing combinations of 512-MB and 1-GB 533-MHz or 667-MHz unbuffered ECC DDR II single or dual-rank memory modules. You can purchase memory upgrade kits from Dell.

Memory Module Installation Guidelines

- If only one memory module is installed, it must be installed in connector DIMM_1.
- If only one memory module is installed in connector DIMM_1, its capacity must be 512 MB.
- If more than one memory module is installed, the memory modules must be installed in pairs of matched memory size, speed, and technology.
- Memory modules must be installed in ordered pairs in connectors DIMM_1 and DIMM_2, and then DIMM_3 and DIMM_4.
- If a processor with a slower front-side bus rating than the memory is installed, the memory will operate at the processor's slower front-side bus speed.

NOTICE: If you remove your original memory modules from the system during a memory upgrade, keep them separate from any new memory modules that you may have, even if you purchased the new memory modules from Dell. Use only unregistered or unbuffered ECC DDR II memory modules.

Table 3-2 illustrates memory configuration guidelines. It is important to follow the slot installation configurations shown here to achieve maximum memory performance.

Table 3-2. Memory Configuration Guidelines

Total Memory	DIMM_1	DIMM_2	DIMM_3	DIMM_4
512 MB	512 MB	none	none	none
1 GB	512 MB	512 MB	none	none
2 GB	512 MB	512 MB	512 MB	512 MB
2 GB	1 GB	1 GB	none	none
3 GB	1 GB	1 GB	512 MB	512 MB
4 GB	1 GB	1 GB	1 GB	1 GB

Addressing Memory With 4-GB Configurations (Microsoft® Windows® Operating System Only)

Your system supports a maximum of 4 GB of memory using four 1-GB memory modules. Current operating systems can use a maximum of 4 GB of address space; however, the amount of memory available to the operating system is slightly less than 4 GB.

NOTE: Depending on the type of PCI/PCIe expansion cards that are installed in your system, your system may only support a maximum of 3.4 GB of memory or less.

The following components require address space:

- System ROM
- Advanced Programmable Interrupt Controllers (APIC)
- Integrated PCI devices (such as NICs) and SCSI controllers
- PCI expansion cards

At start-up, the BIOS identifies the components that require address space. The BIOS dynamically calculates the amount of reserved address space required. The BIOS then subtracts the reserved address space from 4 GB to determine the amount of usable space.

- If the total installed system memory is less than the usable space, all installed system memory is available for use only by the operating system.
- If the total installed system memory is equal to or greater than the usable address space, a small portion of installed memory is available for use by the operating system.

Removing a Memory Module

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Press out on the securing clip at each end of the memory module connector. See Figure 3-14.

4 Grasp the memory module and pull it out of the connector.

   If the module is difficult to remove, gently move the module back and forth to remove it from the connector.

Installing a Memory Module

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Press on the securing clip at each end of the memory module connector. See Figure 3-14.

4 Align the memory module's edge connector with the alignment key in the connector.

   The memory module connector has an alignment key that allows the memory module to be installed in the connector in only one way.

5 Applying even pressure to both ends of the module, insert the module into the connector and carefully press the module into place.

Figure 3-14. Installing and Removing a Memory Module
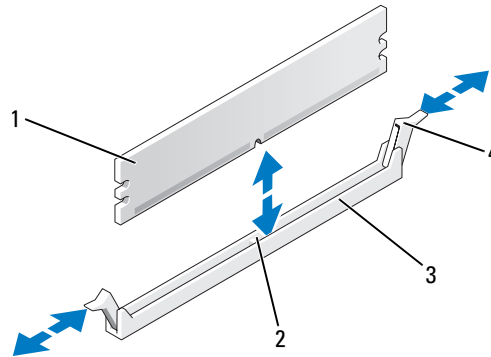
1	memory module	2	alignment key	3	socket
4	memory module socket ejectors (2)				

6 Pull up on the securing clips to lock the module into place.

If you insert the module correctly, the securing clips snap into the cutouts at each end of the module.

When the memory module is properly seated in the connector, the securing clips on the memory module socket should align with the securing clips on the other connectors with memory modules installed.

7 Close the system. See "Closing the System" on page 41.

8 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

The system detects that the new memory does not match the existing configuration information and generates the following message:

```
The amount of system memory has changed.
Strike the F1 key to continue, F2 to run the setup utility
```

9 Press <F2> to enter the System Setup program and check the value for **Memory Info**. See "System Setup Options" on page 28.

The system should have changed the value for **Memory Info** to reflect the newly installed memory. Verify the new value. If it is correct, skip to step 13.

10 If the memory value is incorrect, turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

11 Open the system. See "Opening the System" on page 41.

12 Ensure that the installed memory modules are seated properly in their connectors, and repeat step 7 through step 9.

13 When the **Memory Info** value is correct, press <Esc> to exit the System Setup program.

14 Run the system diagnostics to verify that the memory modules are operating properly. See "Running the System Diagnostics" on page 98.

Microprocessor

You can upgrade the system processor to take advantage of future options in speed and functionality. The processor and its associated internal cache memory are contained in a land grid array (LGA) package.

Removing the Processor

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

⚠ **CAUTION: The processor and heat sink can get very hot during normal operation. Ensure that they have had sufficient time to cool before you touch them.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Using a #2 Phillips screwdriver, loosen the two captive screws holding the heat sink and shroud assembly in place.

These captive screws are adjacent to the processor cooling fan housing. See Figure 3-15.

4 Tilt the heat sink and shroud assembly away from the fan housing and lift it out.

Figure 3-15.   Installing and Removing the Heat Sink
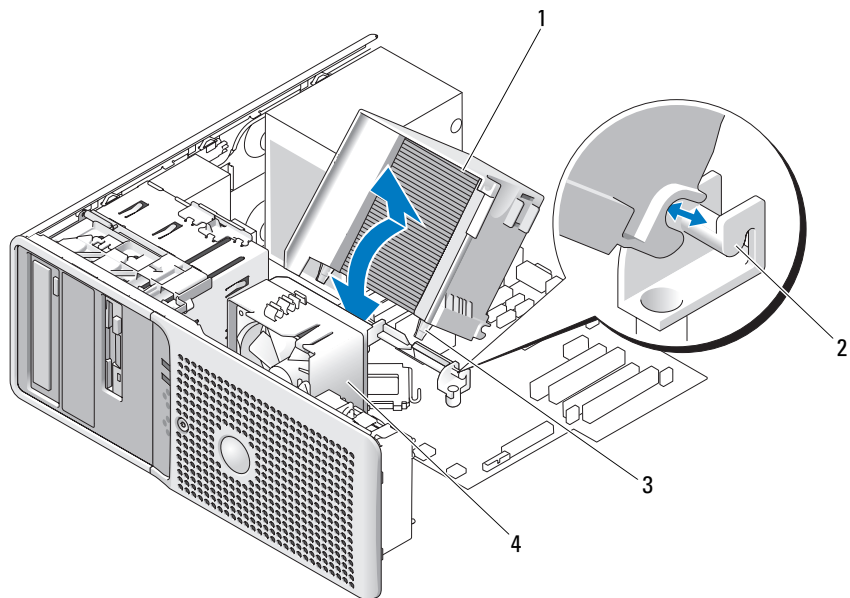
1	heatsink and shroud assembly	2	assembly bracket	3	captive screws (2)
4	processor cooling fan				

5 Open the processor cover by sliding the release lever from under the release lever latch on the socket. Then, pull the lever back to release the processor. See Figure 3-16.

Figure 3-16. Installing and Removing a Processor
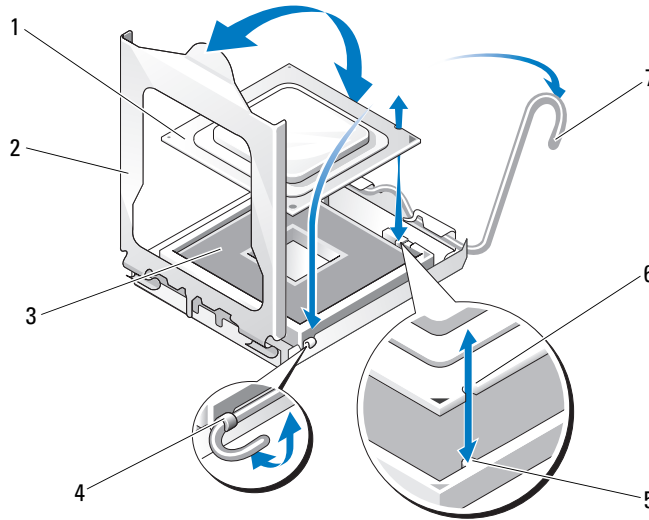
1	processor	2	retention latch	3	socket
4	release lever latch	5	tab	6	notched processor edge
7	release lever				

⊃ **NOTICE:** The retention latch is pressure-loaded. Ensure that the latch does not quickly open and strike the processor or system board.

6 Carefully pivot the retention latch away from the processor.

⊃ **NOTICE:** Do not pry the processor from the socket by a single edge. This could result in damage to the processor's delicate connections.

⊃ **NOTICE:** Be careful not to touch or drop any foreign materials on the socket connector pads.

7 Lift the processor straight up and out of the socket.

Leave the release lever and retention latch in the release position so that the socket is ready for the new processor.

Replacing the Processor

1 Unpack the new processor.

2 Ensure that the contacts on the bottom of the replacement processor are free from dirt or other foreign material.

3 Align the notched edge of the replacement processor with the tab on the processor frame. See Figure 3-16.

◯ **NOTICE:** Use caution when removing and installing the processor. Damaging the processor socket connectors can damage the system board.

4 Carefully set the processor in the processor frame. Ensure that the notched edge of the processor fits securely over the matching tab on the processor frame. Do not press down on the processor. If the processor is seated correctly, it should fit snugly in the socket frame. See Figure 3-16.

5 Lower the retention latch onto the processor, and then rotate the release lever latch back toward the system board until it snaps into place.

6 Clean the thermal grease from the bottom of the heat sink.

◯ **NOTICE:** Ensure that you apply new thermal grease. Applying new thermal grease is critical to ensuring proper thermal bonding as well as optimal processor operation.

7 Apply new thermal grease to the top of the processor.

8 Place the heat sink assembly back onto the heat sink assembly bracket and tilt the heat sink assembly down on the system board. See Figure 3-15.

9 Align the two captive screws properly with the system board, then tighten them to secure the heat sink assembly to the system board.

10 Close the system. See "Closing the System" on page 41.

11 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

Cooling Fans

The system contains two cooling fans, one for the processor and one for the card cage. Each contains a shroud that is part of the cooling fan assembly. The fan and shroud are replaced as a unit.

✍ **NOTE:** If you are removing the larger processor cooling fan, you must first remove the heat sink and shroud assembly. See "Removing the Processor" on page 62 (however, do not remove the processor) and Figure 3-17.

Removing the Cooling Fans

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Disconnect the fan's power cable from the system board. See Figure 3-17.

4 If you are removing the smaller card cage fan (see Figure 3-17):

    a Pull up on the single release tab that attaches the fan to the chassis.

    b Slide the fan toward the back panel and lift the fan out.

5 If you are removing the larger processor cooling fan (see Figure 3-17):

    a Remove the heat sink and shroud assembly. See "Removing the Processor" on page 62. Do not remove the processor, however.

    b Press the release tab that attaches the processor cooling fan to the chassis.

    c Slide the fan toward the back panel and lift the fan out.

Figure 3-17. Removing and Installing the Cooling Fans
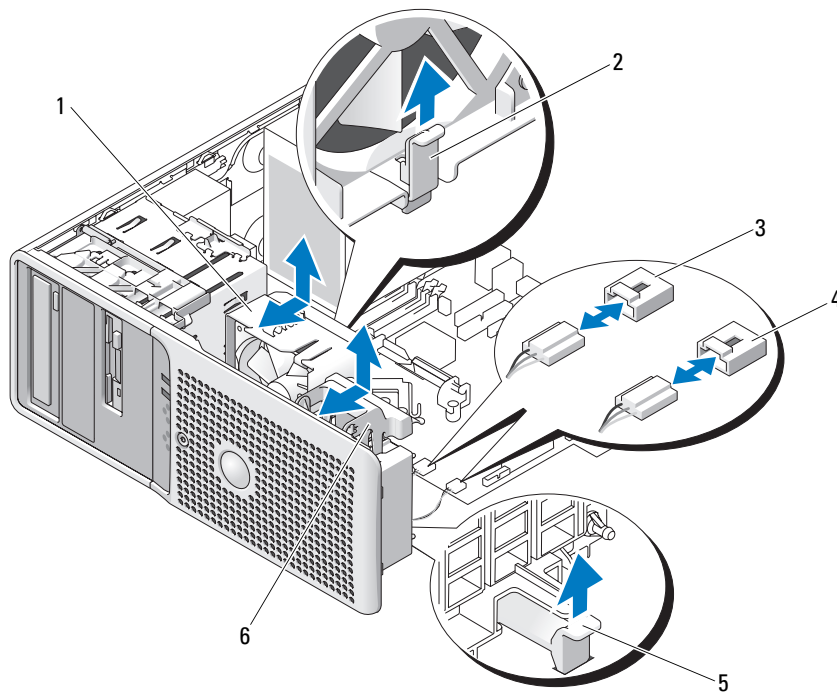
1	processor cooling fan	2	release tab for processor fan	3	connector for processor fan (CPU_CAGE)
4	connector for card cage fan (FAN_CARD_CAGE)	5	release tab for card cage fan	6	card cage fan

Replacing the Cooling Fans

1 Align the securing tabs on the replacement fan with the mounting holes in the system chassis.

2 Slide the fan toward the front panel until it snaps into place.

3 If you replaced the larger processor cooling fan, replace the heat sink and shroud assembly (see "Removing the Processor" on page 62).

4 Reconnect the fan power cable to the system board.

5 Close the system. See "Closing the System" on page 41.

System Battery

A coin-cell battery maintains system configuration, date, and time information. The battery can last several years.

To determine whether you need to replace the battery, see "Troubleshooting the System Battery" on page 85.

You can operate your system without a battery; however, without a battery, the configuration information is erased if the system is turned off or unplugged from the electrical outlet. In this case, you must enter the System Setup program and reset the configuration options.

⚠ CAUTION: A new battery can explode if it is incorrectly installed. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Removing the System Battery

⚠ CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

1 Enter the System Setup program and record the option settings on the System Setup screens. See "Using the System Setup Program" on page 27.

2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system. See "Opening the System" on page 41.

4 See Figure 6-2 for the location of the system battery and then remove any cables that block access to the battery.

● NOTICE: If you use a blunt, nonconductive object to depress the tab next to the battery, be careful not to touch the system board with the object. Ensure that the object is inserted between the battery and the tab before you attempt to depress the tab. Do not pry out the battery. You may damage the system board by prying off the socket or by breaking circuit traces on the system board.

5 Press the tab on the battery socket to release the battery, then lift the battery out of the socket. See Figure 3-18.

1	battery socket	2	system battery	3	tab

Installing the System Battery

1 Install the new battery with the "+" facing up, and press down until it snaps into place. See Figure 3-18.

2 Close the system. See "Closing the System" on page 41.

3 Reconnect the system to the electrical outlet and turn on the system and attached peripherals.

4 Enter the System Setup program to confirm that the battery operates properly. See "Using the System Setup Program" on page 27.

5 From the main screen, select **System Time** to enter the correct time and date.

6 Re-enter any system configuration information that is no longer displayed on the System Setup screens, and then exit the System Setup program.

7 To test the newly installed battery, see "Troubleshooting the System Battery" on page 85.

8 After an hour, reconnect the system to a power source and turn it on.

9 Enter the System Setup program. If the time and date are still incorrect, see "Getting Help" on page 107.

10 Properly dispose of the old battery. For more information, see your *Product Information Guide*.

Power Supply

Removing the Power Supply

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Depending on your system configuration, disconnect the following power cables:

- P1 and P2 to the system board
- P3 and P5 to the SATA or SAS drives
- P7 to the diskette drive
- P8, P9, and P10 to the optical and tape drives

   ✍ **NOTE:** Note the routing of the DC power cables underneath the tabs in the system frame as you release the tabs and remove the cables from the system board and drives. You must route these cables properly when you replace them to prevent their being pinched or crimped.

4 Remove the heat sink and shroud assembly. Loosen the two captive screws holding the heat sink and shroud assembly in place.

   These captive screws are adjacent to the processor cooling fan housing. See Figure 3-15.

5 Tilt the heat sink and shroud assembly away from the fan housing and lift it out.

6 Remove the IDE, I/O panel, and SATA cables (if present) attached to the routing clamps on the side of the power supply.

7 Using a #2 Phillips screwdriver, remove the four Phillips screws that secure the power supply to the back panel.

8 Press the power-supply release tab down and slide the power supply toward the front of the system, then lift it out of the system chassis. See Figure 3-19.

9 Remove the cable clamp and set it aside to attach to the new power supply.

Figure 3-19.   Removing the Power Supply
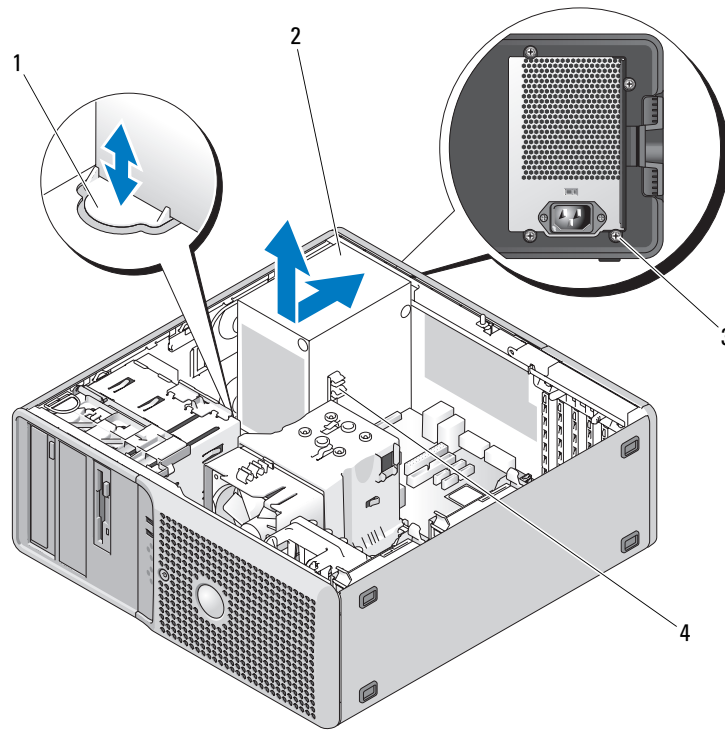
1	power supply release tab	2	power supply	3	screws (4)
4	cable clamp				

Installing the Power Supply

1   Attach the cable clamp to the new power supply.

2   Align the power supply mounting holes with the mounting holes on the back panel.

3   Slide the power supply toward the back panel until it snaps into place over the power-supply release tab.

4   Using a #2 Phillips screwdriver, install the four Phillips screws that secure the power supply to the back panel.

5   Reattach the IDE, I/O panel, and SATA cables (if present) to the routing clamp on the side of the power supply.

6   Depending on your system configuration, connect the following power cables:

   •   P1 and P2 to the system board

   •   P3 and P5 to the SATA or SAS drives

- • P7 to the diskette drive
- • P8, P9, and P10 to the optical and tape drives
7 Close the system. See "Closing the System" on page 41.

Chassis Intrusion Switch

Removing the Chassis Intrusion Switch

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**
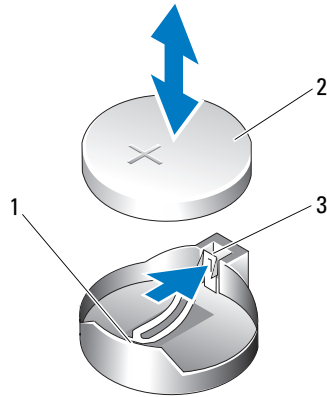
1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Disconnect the chassis intrusion switch cable from the INTRUDER connector on the system board. See Figure 3-20.

4 Slide the chassis intrusion switch out of the securing bracket notch. See Figure 3-20.

5 Remove the switch and its attached cable from the system.

Figure 3-20.   Removing and Installing the Chassis Intrusion Switch

| 1 | chassis intrusion switch | 2 | securing bracket notch | 3 | INTRUDER connector |
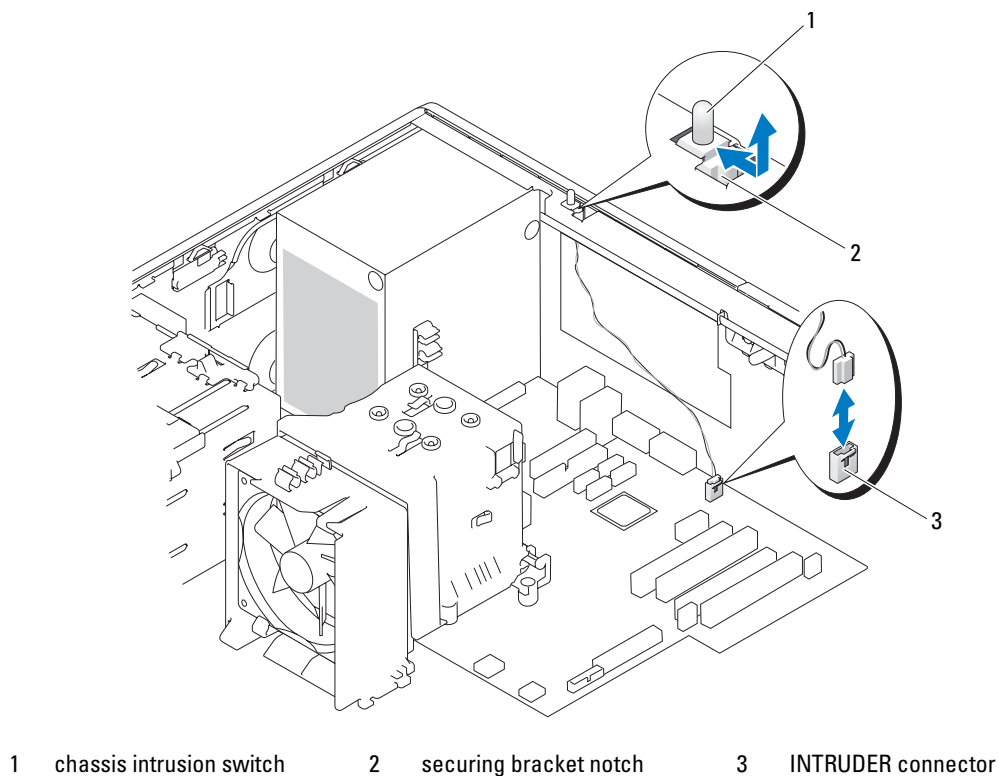
Installing the Chassis Intrusion Switch

1 Align the chassis intrusion switch with the securing bracket notch. See Figure 3-20.

2 Slide the switch into the securing bracket notch.

3 Connect the switch cable to the INTRUDER connector on the system board.

4 Close the system. See "Closing the System" on page 41.

5 Reconnect the system to the electrical outlet, and turn on the system.

Bezel (Service Only Parts Procedure)

Removing the Bezel

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Remove the heat sink and shroud assembly. See "Removing the Processor" on page 62. Do not remove the processor, however.

4 Remove the large processor cooling fan. See "Removing the Cooling Fans" on page 65.

5 Remove the three bezel release screws. See Figure 3-21.

6 Slide the bezel toward the top of the system, then lift it outward.

Figure 3-21.   Removing the Bezel
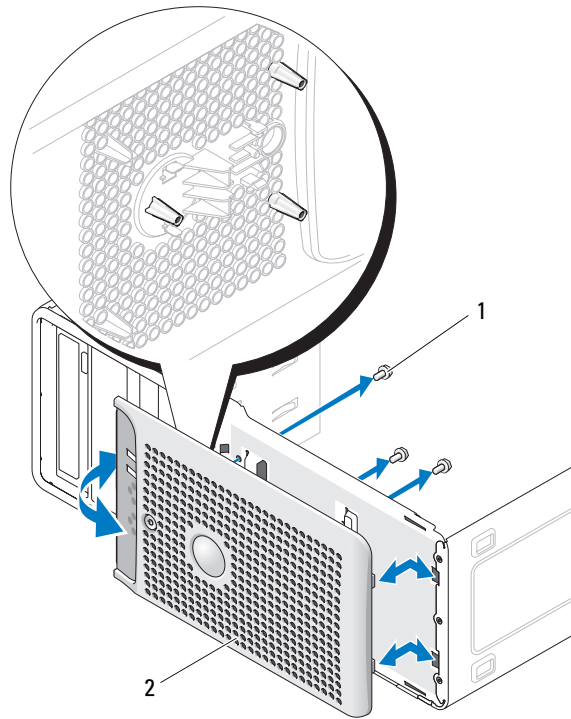
1	bezel release screws (3)	2	bezel

Replacing the Bezel

1 Align the bezel with the chassis frame and slide it into position.

2 Attach the three bezel release screws to secure the bezel to the system chassis. See Figure 3-21.

3 Replace the processor fan. See "Replacing the Cooling Fans" on page 67.

4 Reinstall the heat sink and shroud assembly. See "Replacing the Processor" on page 65.

5 Close the system. See "Closing the System" on page 41.

6 Reconnect the system to the electrical outlet, and turn on the system.

I/O Panel Assembly (Service Only Parts Procedure)

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

Removing the I/O Panel Assembly

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Remove the heat sink and shroud assembly. See "Removing the Processor" on page 62. Do not remove the processor, however.

4 Remove the processor cooling fan. See "Removing the Cooling Fans" on page 65.

5 Remove the front bezel. See "Removing the Bezel" on page 73.

☐ **NOTICE:** Carefully note the routing of each cable before you disconnect it, so that you are sure to re-route cables correctly.

6 Disconnect the I/O panel ribbon cable from the I/O panel connector by pulling the yellow cable loop.

7 Remove the mounting screw holding the I/O panel assembly to the front chassis. See Figure 3-22.

8 Lift the I/O panel assembly out of the system.

Figure 3-22. Removing and Installing the I/O Panel Assembly

| 1 | I/O panel assembly | 2 | I/O panel ribbon cable | 3 | holding tab on the chassis |
| 4 | screw on the I/O panel | | | | |

Replacing the I/O Panel Assembly

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Fit the I/O panel assembly into the holding tab on the front of the chassis. See Figure 3-22.

2 Secure the I/O panel assembly by replacing the screw. See Figure 3-22.

3 Connect the I/O panel ribbon cable to the new I/O panel connector.

4 Replace the large processor cooling fan. See "Replacing the Cooling Fans" on page 67.

5 Replace the heat sink and shroud assembly. See "Replacing the Processor" on page 65.

✎ **NOTE:** To prevent damaging the processor, clean the heat sink to remove any thermal grease and then apply fresh thermal grease to the processor before installing the heat sink.

6 Close the system. See "Closing the System" on page 41.

7 Reconnect the system to the electrical outlet, and turn on the system.

System Board (Service Only Parts Procedure)

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

⚠ **CAUTION: The heat sink can get hot during operation. To avoid burns, ensure that the system has sufficient time to cool before removing the system board.**

Removing the System Board

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Depending on your configuration, disconnect the following cables from the system board. See Figure 6-2 for connector locations.

- Two power-supply cables from the POWER and 12VPOWER connectors
- Diskette data cable from the FLOPPY connector
- I/O panel cable from the FRONTPANEL connector
- 5.25-inch device data cable from the IDE connector
- Processor cooling fan cable from the FAN_CPU connector
- Card cage cooling fan cable from the FAN_CARD_CAGE connector

- SATA hard-drive data cable(s) from the SATA connector(s)
- Intrusion switch cable from the INTRUDER connector

4 Remove all expansion cards and any attached cables. See "Removing an Expansion Card" on page 56.

5 Remove all memory modules. See "Memory" on page 58.

NOTE: Record the memory-module socket locations to ensure proper reinstallation of the memory modules.

⚠ **CAUTION: The processor and heat sink can become extremely hot. Allow sufficient time for the processor and heat sink to cool before handling.**

NOTICE: To prevent damaging the processor, do not pry the heat sink off of the processor.

6 Remove the processor. See "Removing the Processor" on page 62.

7 Using a #2 Phillips screwdriver, remove the eight system board mounting screws that secure the system board to the chassis. See Figure 3-23.

8 Using a #2 Phillips screwdriver, remove the two processor heat sink pivot mount screws and remove the pivot mount from the system board. See Figure 3-23. The heat sink pivot mount screws are green and are longer than the system board mounting screws.

Figure 3-23. System Board Mounting Points

| 1 | heat sink pivot mount screws (2) | 2 | system board mounting screws (8) | 3 | system board |
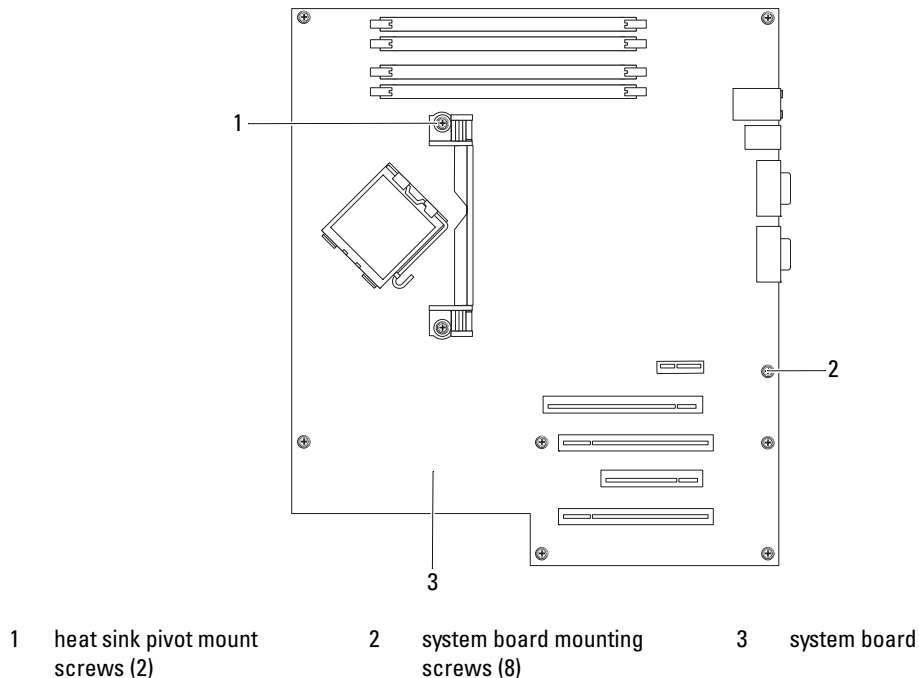
9 Carefully route any loose cables away from the edges of the system board.

10 Gently slide the system board toward the front of the system, then lift the system board up and out of the chassis.

Installing the System Board

1 After removing the old system board, lower the new system board into the chassis, aligning the I/O ports on the system board with the I/O connector openings on the back panel of the chassis.

2 Using a #2 Phillips screwdriver, install the eight screws on the system board that secure it to the chassis. See Figure 3-23.

3 Using a #2 Phillips screwdriver, attach the processor heat sink pivot mount to the system board. See Figure 3-23.

NOTICE: To prevent damaging the processor, clean the heat sink to remove any thermal grease and then apply fresh thermal grease to the processor before installing the heat sink.

4 Replace the processor, and the heat sink and shroud assembly. See "Replacing the Processor" on page 65.

5 Install the memory modules in the same sockets from which they were removed. See "Installing a Memory Module" on page 60.

6 Install the expansion cards and connect any cables. See "Installing an Expansion Card" on page 57.

7 Depending on your configuration, connect the following cables that you removed in "Removing the System Board" on page 76. See Figure 6-2.

- Two power-supply cables to the POWER and 12VPOWER connectors
- If applicable, diskette data cable to the FLOPPY connector
- I/O panel cable to the FRONTPANEL connector
- 5.25-inch device data cable to the IDE connector
- Processor cooling fan cable to the FAN_CPU connector
- Card cage cooling fan cable to the FAN_CARD_CAGE connector
- SATA hard-drive data cable(s) to the SATA connector(s)
- Intrusion switch cable from the INTRUDER connector

8 Close the system. See "Closing the System" on page 41.

9 Reconnect the system to the electrical outlet, and turn on the system.

4

Troubleshooting Your System

Safety First—For You and Your System

To perform certain procedures in this document, you must remove the system cover and work inside the system. While working inside the system, do not attempt to service the system except as explained in this guide and elsewhere in your system documentation.
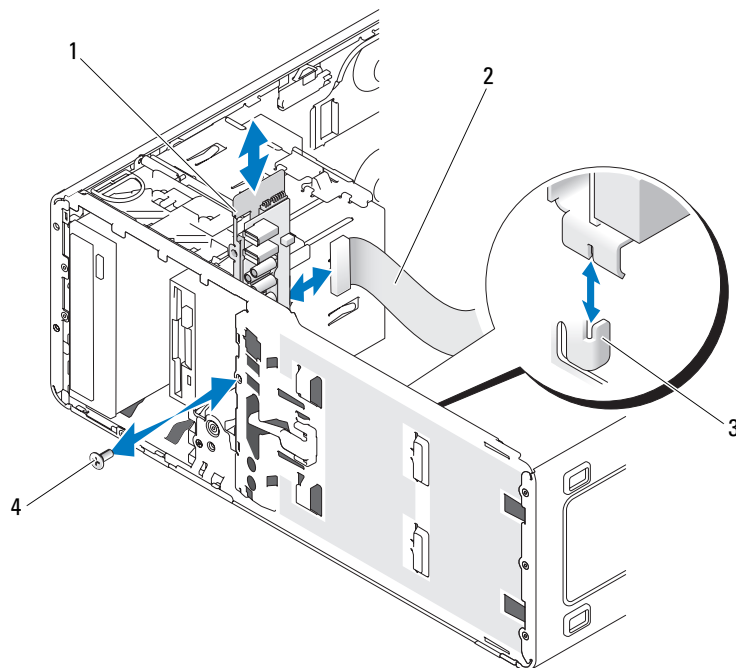
⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

Start-Up Routine

Look and listen during the system's start-up routine for the indications described in Table 4-1.

Table 4-1.   Start-Up Routine Indications

Look/listen for:	Action
A code displayed on the system diagnostic indicators.	See "Diagnostic Lights" on page 15.
An error message displayed on the monitor.	See "System Messages" on page 16.
The monitor's power indicator.	See "Troubleshooting the Video Subsystem" on page 81.
The keyboard indicators.	See "Troubleshooting the Keyboard" on page 81.
The diskette drive activity indicator.	See "Troubleshooting a Diskette Drive" on page 89.
The CD drive activity indicator.	See "Troubleshooting an Optical Drive" on page 90.
The hard-drive activity indicator.	See "Troubleshooting a Hard Drive" on page 91.
An unfamiliar constant scraping or grinding sound when you access a drive.	See "Getting Help" on page 107.

Checking the Equipment

This section provides troubleshooting procedures for external devices attached to the system, such as the monitor, keyboard, or mouse. Before you perform any of the procedures, see "Troubleshooting External Connections" on page 80.

Troubleshooting IRQ Assignment Conflicts

Most PCI devices can share an IRQ with another device, but they cannot use an IRQ simultaneously. To avoid this type of conflict, see the documentation for each PCI device for specific IRQ requirements. Table 4-2 lists the IRQ assignments.

Table 4-2.   IRQ Assignment Defaults

IRQ Line	Assignment
IRQ0	System timer
IRQ1	Keyboard controller
IRQ2	Interrupt controller 1 to enable IRQ8 through IRQ15
IRQ3	Serial port 2 (COM2 and COM4)
IRQ4	Serial port 1 (COM1 and COM3)
IRQ5	Remote access controller
IRQ6	Diskette drive (optional) controller
IRQ8	Real-time clock
IRQ9	ACPI functions (used for power management)
IRQ10	*Available*
IRQ11	*Available*
IRQ13	Math coprocessor
IRQ14	IDE CD drive controller
IRQ15	*Available*

Troubleshooting External Connections

Loose or improperly connected cables are the most likely source of problems for the system, monitor, and other peripherals (such as a printer, keyboard, mouse, or other external device). Ensure that all external cables are securely attached to the external connectors on your system. See Figure 1-2 for the back-panel connectors on your system.

Troubleshooting the Video Subsystem

Problem

- Monitor is not working properly.

Action

1 Check the system and power connections to the monitor.
2 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

   If the tests run successfully, the problem is not related to video hardware.

   If the problem is not resolved, see "Getting Help" on page 107.

Troubleshooting the Keyboard

Problem

- System message indicates a problem with the keyboard.
- Keyboard is not functioning properly.

Action

1 Enter the System Setup program and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 27.
2 Examine the keyboard and its cable for signs of damage.
3 Swap the faulty keyboard with a working keyboard.

   If the problem is resolved, replace the faulty keyboard. See "Getting Help" on page 107.
4 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

   If the problem is not resolved, see "Getting Help" on page 107.

Troubleshooting the Mouse

Problem

- System message indicates a problem with the mouse.
- Mouse is not functioning properly.

Action

1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

   If the test fails, continue to the next step.

2 Examine the mouse and its cable for signs of damage.

If the mouse is not damaged, go to step 4.

If the mouse is damaged, continue to the next step.

3 Swap the faulty mouse with a working mouse.

If the problem is resolved, replace the faulty mouse. See "Getting Help" on page 107.

4 Enter the System Setup program and ensure that the USB port is enabled. See "Using the System Setup Program" on page 27.

If the problem is not resolved, see "Getting Help" on page 107.

Troubleshooting Basic I/O Problems

Troubleshooting a Serial Port

Problem

• Error message indicates a problem with a serial port.

• Device connected to a serial port is not operating properly.

Action

1 Enter the System Setup program and ensure that the serial port is enabled and configured correctly for your application. See "Using the System Setup Program" on page 27.

2 If the problem is confined to a particular application, see the application documentation for specific port configuration requirements that the program may require.

3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

If the tests run successfully but the problem persists, see "Getting Help" on page 107.

Troubleshooting a USB Device

Problem

• System message indicates a problem with a USB device.

• Device connected to a USB port is not operating properly.

Action

1 Enter the System Setup program and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 27.

2 Turn off the system and any USB devices.

3 Disconnect the USB devices, and connect the malfunctioning device to the other USB connector.

4 Turn on the system and the reconnected device.

If the problem is resolved, the USB connector might be defective. See "Getting Help" on page 107.

5 If possible, swap the interface cable with a working cable.

If the problem is resolved, replace the interface cable. See "Getting Help" on page 107.

6 Turn off the system and the USB device, and swap the device with a comparable device.

7 Turn on the system and the USB device.

If the problem is resolved, replace the USB device. See "Getting Help" on page 107.

If the problem persists, see "Getting Help" on page 107.

Troubleshooting a NIC

Problem

- NIC cannot communicate with network.

Action

1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

2 Check the appropriate indicator on the NIC connector.

- If the link indicator does not light, check all cable connections.
- If the activity indicator does not light, the network driver files might be damaged or missing. Remove and reinstall the drivers if applicable. See the NIC's documentation.
- Change the autonegotiation setting, if possible.
- Use another connector on the switch or hub.

If you are using a NIC card instead of an integrated NIC, see the documentation for the NIC card.

3 Ensure that the appropriate drivers are installed and the protocols are bound. See the NIC's documentation.

4 Enter the System Setup program and confirm that the NICs are enabled. See "Using the System Setup Program" on page 27.

5 Ensure that the NICs, hubs, and switches on the network are all set to the same data transmission speed. See the network equipment documentation.

6 Ensure that all network cables are of the proper type and do not exceed the maximum length.

If the problem persists, see "Getting Help" on page 107.

Troubleshooting a Wet System

Problem

- Liquid spilled on the system.
- Excessive humidity.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 56.

4 Let the system dry thoroughly for at least 24 hours.

5 Close the system. See "Closing the System" on page 41.

6 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

   If the system does not start properly, see "Getting Help" on page 107.

7 If the system starts properly, shut down the system and reinstall all of the expansion cards that you removed. See "Installing an Expansion Card" on page 57.

8 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

   If the tests fail, see "Getting Help" on page 107.

Troubleshooting a Damaged System

Problem

- System was dropped or damaged.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Open the system. See "Opening the System" on page 41.

2 Ensure that the following components are properly installed:

   - Expansion cards
   - Power supply

- Fans
- Processors and heat sinks
- Optional installed drivers
- Memory modules
3 Ensure that all cables are properly connected.
4 Close the system. See "Closing the System" on page 41.
5 Run the system board tests in the system diagnostics. See "Running the System Diagnostics" on page 97.

   If the tests fail, see "Getting Help" on page 107.

Troubleshooting the System Battery

Problem
- System message indicates a problem with the battery.
- System Setup program loses system configuration information.
- System date and time do not remain current.

✍ **NOTE:** If the system is turned off for long periods of time (for weeks or months), the NVRAM may lose its system configuration information. This situation is caused by a defective battery.

Action
1 Re-enter the time and date through the System Setup program. See "Using the System Setup Program" on page 27.
2 Turn off the system and disconnect it from the electrical outlet for at least one hour.
3 Reconnect the system to the electrical outlet and turn on the system.
4 Enter the System Setup program. See "Using the System Setup Program" on page 27.

   If the date and time are not correct in the System Setup program, replace the battery. See "System Battery" on page 67.

   If the problem is not resolved by replacing the battery, see "Getting Help" on page 107.

✍ **NOTE:** Some software may cause the system time to speed up or slow down. If the system seems to operate normally except for the time kept in the System Setup program, the problem may be caused by software rather than by a defective battery.

Troubleshooting Power Supply

Problem

- Power-supply fault indicator is blinking amber.

Action

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1   Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2   Open the system. See "Opening the System" on page 41.

3   Check that the voltage selection switch on the back panel of the system is set properly. See "Power Supply Indicators" on page 15.

⊘ **NOTICE:** Setting the voltage selection switch to an improper setting can damage your system.

4   Ensure that the power supply is properly installed by removing and reinstalling it. See "Installing the Power Supply" on page 70.

   ✎ **NOTE:** After installing a power supply, allow several seconds for the system to recognize the power supply and to determine if it is working properly. The power indicator turns green to signify that the power supply is functioning properly.

5   If the problem is resolved, close the system. See "Closing the System" on page 41.

   If the problem persists, remove the faulty power supply. See "Removing the Power Supply" on page 69.

6   Install a new power supply. See "Installing the Power Supply" on page 70.

   If the problem persists, see "Getting Help" on page 107.

Troubleshooting System Cooling Problems

Problem

- Systems management software issues a fan-related error message.

Action

Ensure that none of the following conditions exist:

- System cover, drive blank, or front or back filler panel is removed.
- Ambient temperature is too high.
- External airflow is obstructed.

- Cables inside the system obstruct airflow.
- An individual cooling fan is removed or has failed. See "Troubleshooting a Fan" on page 87.

Troubleshooting a Fan

Problem

- System-status indicator is amber.
- System message indicates a fan-related error message.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Run the appropriate diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system. See "Opening the System" on page 41.

4 Ensure that the faulty fan's power cable is firmly attached to the fan power connector. See "Cooling Fans" on page 65.

5 Close the system. See "Closing the System" on page 41.

6 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.

7 If the problem is not resolved, install a new fan. See "Cooling Fans" on page 65.

    If the replacement fan is working properly, close the system. See "Closing the System" on page 41.

    If the replacement fan does not operate, see "Getting Help" on page 107.

Troubleshooting System Memory

Problem

- Faulty memory module.
- Faulty system board.
- Diagnostic indicator code indicates a problem with system memory.

Action

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

2 Turn off the system and attached peripherals, and then turn them on again.

   If an error message does not appear, continue to the next step.

   If an error message appears, go to step 11.

3 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 27.

   If the amount of memory installed matches the system memory setting, go to step 11.

4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

5 Open the system. See "Opening the System" on page 41.

6 Ensure that the memory banks are populated correctly. See "Memory Module Installation Guidelines" on page 59.

   If the memory modules are populated correctly, continue to the next step.

7 Reseat the memory modules in their sockets. See "Installing a Memory Module" on page 60.

8 Close the system. See "Closing the System" on page 41.

9 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.

10 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 27. If the amount of memory installed still does not match the system memory setting, proceed to the next step.

11 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.

12 Open the system. See "Opening the System" on page 41.

📝 **NOTE:** Several configurations for the memory modules exist; see "Memory Module Installation Guidelines" on page 59.

13 If a diagnostic test or error message indicates a specific memory module as faulty, swap or replace the module. Otherwise, swap the memory module in socket 1 with a module of the same type and capacity that is known to be good. See "Installing a Memory Module" on page 60.

14 Close the system. See "Closing the System" on page 41.

15 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.

16 As the system boots, observe any error message that appears and the diagnostic indicators on the front of the system.

17 If the memory problem is still indicated, repeat step 11 through step 16 for each memory module installed.

If the problem persists, see "Getting Help" on page 107.

Troubleshooting a Diskette Drive

Problem

• Error message indicates a diskette drive problem.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Enter the System Setup program and verify that the diskette drive is configured correctly. See "Using the System Setup Program" on page 27.

2 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

3 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

4 Open the system. See "Opening the System" on page 41.

5 Ensure that the diskette drive interface cable is securely connected to the diskette drive and the system board.

6 Ensure that a power cable is properly connected to the drive.

7 Close the system. See "Closing the System" on page 41.

8 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

9 Run the appropriate online diagnostic test to see whether the diskette drive works correctly.

If the problem persists, continue with the following steps.

10 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.

11 Open the system. See "Opening the System" on page 41.

12 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 56.

13 Close the system. See "Closing the System" on page 41.

14 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

15 Run the appropriate online diagnostic test to see whether the diskette drive works correctly.

If the tests run successfully, an expansion card may be conflicting with the diskette drive logic, or an expansion card may be faulty. Continue to the next step.

If the tests fail, see "Getting Help" on page 107.

16 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

17 Open the system. See "Opening the System" on page 41.

18 Reinstall one of the expansion cards you removed in step 12. See "Installing an Expansion Card" on page 57.

19 Close the system. See "Closing the System" on page 41.

20 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

21 Run the appropriate online diagnostic test to see whether the diskette drive works correctly.

22 Repeat step 16 through step 21 until all expansion cards are reinstalled or one of the expansion cards causes the tests to fail.

If the problem is not resolved, see "Getting Help" on page 107.

Troubleshooting an Optical Drive

Problem

- System cannot read data from a CD or DVD in an optical drive.
- Optical drive indicator does not blink during boot.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Try using a different CD or DVD that you know works properly.

2 Enter the System Setup program and ensure that the drive's IDE controller is enabled. See "Using the System Setup Program" on page 27.

3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

5 Open the system. See "Opening the System" on page 41.

6 Ensure that the interface cable is securely connected to the optical drive and to the controller.

7 Ensure that a power cable is properly connected to the drive.

8 Close the system. See "Closing the System" on page 41.

9 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem is not resolved, see "Getting Help" on page 107.

Troubleshooting an IDE Tape Drive

Problem

- System cannot read data from a tape in an IDE tape drive.
- Diagnostic indicators or system messages indicate a tape drive-related failure.
- Tape drive indicator (if applicable) does not blink during boot.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Try using a different tape that you know works properly.

  If the problem persists, continue with the following steps.

2 Enter the System Setup program and ensure that the drive's IDE controller is enabled. See "Using the System Setup Program" on page 27.

3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

5 Open the system. See "Opening the System" on page 41.

6 Ensure that the IDE interface cable is securely connected to the tape drive and to the IDE connector on the system board.

7 Ensure that a power cable is properly connected to the drive.

8 Close the system. See "Closing the System" on page 41.

9 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

  If the problem is not resolved, see "Getting Help" on page 107.

Troubleshooting a Hard Drive

Problem

- Device driver error.
- One or more hard drives not recognized by the system.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

⊘ NOTICE: This troubleshooting procedure can destroy data stored on the hard drive. Before you proceed, back up all files on the hard drive.

1 Run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 97.

   Depending on the results of the diagnostics test, proceed as needed through the following steps.

2 If you are experiencing problems with multiple hard drives, skip to step 5. For a problem with a single hard drive, continue to the next step.

3 If your system has a SAS RAID controller, perform the following steps.

   a Restart the system and press <Ctrl><R> to enter the host adapter configuration utility program.

   See the documentation supplied with the host adapter for information about the configuration utility.

   b Ensure that the hard drive has been configured correctly for the RAID.

   c Exit the configuration utility and allow the system to boot to the operating system.

4 Ensure that the required device drivers for your SAS controller card or SAS RAID controller are installed and are configured correctly. See the operating system documentation for more information.

5 Check the cable connections inside the system:

   a Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

   b Open the system. See "Opening the System" on page 41.

   c Verify that the cable connections between the hard drive(s) and the drive controller are correct, whether the connections are to the SATA connectors on the system board, a SAS expansion card, or a SAS RAID controller. See "Hard Drives" on page 51.

   d Verify that the SAS or SATA cables are securely seated in their connectors.

   e Close the system. See "Closing the System" on page 41.

   f Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

   If the problem persists, see "Getting Help" on page 107.

Troubleshooting a SAS RAID Controller

✐ NOTE: When troubleshooting a SAS RAID controller, also see the documentation for your operating system and the controller.

Problem

- Error message indicates a problem with the SAS RAID controller.
- SAS RAID controller performs incorrectly or not at all.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 97.

2 Enter the System Setup program and ensure that the SAS RAID controller is enabled. See "Using the System Setup Program" on page 27.

3 Restart the system and press <Ctrl><C> for the installed controller card to enter the configuration utility program.

   See the controller's documentation for information about configuration settings.

4 Check the configuration settings, make any necessary corrections, and restart the system.

   If the problem is not resolved, continue to the next step.

5 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.

6 Open the system. See "Opening the System" on page 41.

7 Ensure that the controller card is firmly seated into the system board connector. See "Installing an Expansion Card" on page 57.

8 Verify that the cable connections between the hard drives and the SAS controller are correct. See "Hard Drives" on page 51.

   Ensure that the cables are firmly connected to the SAS controller and the hard drives.

9 Close the system. See "Closing the System" on page 41.

10 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals. If the problem persists, see "Getting Help" on page 107.

Troubleshooting Expansion Cards

📝 **NOTE:** When troubleshooting an expansion card, see the documentation for your operating system and the expansion card.

Problem

• Error message indicates a problem with an expansion card.

• Expansion card performs incorrectly or not at all.

Action

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1   Run the appropriate online diagnostic test for the expansion card which is exhibiting issues. See "Using Dell PowerEdge Diagnostics" on page 97. Follow any recommended actions provided by the diagnostics. If the problem persists, go to the next step.

2   Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

3   Open the system. See "Opening the System" on page 41.

4   Ensure that each expansion card is firmly seated in its connector. See "Installing an Expansion Card" on page 57.

5   Close the system. See "Closing the System" on page 41.

6   Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

    If the problem persists, go to the next step.

7   Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

8   Open the system. See "Opening the System" on page 41.

9   Remove all expansion cards in the system. See "Removing an Expansion Card" on page 56.

📝 **NOTE:** If your operating system is running off a disk controller card (such as a SAS controller card), do not remove it.

10 Close the system. See "Closing the System" on page 41.

11 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

12 Run the appropriate online diagnostic test for any item in the system that doesn't require an expansion card.

13 If the problem persists, run the appropriate online diagnostic test on each card. See "Using Dell PowerEdge Diagnostics" on page 97.

    a   Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

    b   Open the system. See "Opening the System" on page 41.

    c   Remove an expansion card. See "Removing an Expansion Card" on page 56.

    d   Close the system. See "Closing the System" on page 41.

    e   Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

    f   Run the appropriate online diagnostic test.

        If the tests fail, repeat step 13 for each expansion card until you are able to single out the faulty expansion card.

        If the tests fail for all expansion cards, see "Getting Help" on page 107.

Troubleshooting the Microprocessor

Problem

- Error message indicates a processor problem.
- Diagnostic indicator code indicates a problem with the processor or system board.
- A heat sink is not installed for the processor.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 If possible, run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 97.

2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system. See "Opening the System" on page 41.

4 Ensure that the processor and heat sink are properly installed. See "Replacing the Processor" on page 65.

5 Close the system. See "Closing the System" on page 41.

6 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

7 If possible, run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 97.

   If the tests fail or the problem persists, continue to the next step.

8 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

9 Open the system. See "Opening the System" on page 41.

10 Replace the processor. See "Replacing the Processor" on page 65.

11 Close the system. See "Closing the System" on page 41.

12 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

13 Run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 97.

   If the problem persists, the system board is faulty. See "Getting Help" on page 107.

5

Running the System Diagnostics

If you experience a problem with your system, run the diagnostics before calling for technical assistance. The purpose of the diagnostics is to test your system's hardware without requiring additional equipment or risking data loss. If you are unable to fix the problem yourself, service and support personnel can use diagnostics test results to help you solve the problem.

Using Dell PowerEdge Diagnostics

To assess a system problem, first use the online Dell® PowerEdge® Diagnostics. Dell PowerEdge Diagnostics is a suite of diagnostic programs, or test modules, that include diagnostic tests on chassis and storage components such as hard drives, physical memory, communications and printer ports, NICs, CMOS, and more. If you are unable to identify the problem using the PowerEdge Diagnostics, then use the system diagnostics.

The files required to run PowerEdge Diagnostics for systems running supported Microsoft® Windows® and Linux operating systems are available at **support.dell.com** and on the CDs that came with your system. For information about using diagnostics, see the *Dell PowerEdge Diagnostics User's Guide*.

System Diagnostics Features

The system diagnostics provides a series of menus and options for particular device groups or devices. The system diagnostics menus and options allow you to:

- Run tests individually or collectively.
- Control the sequence of tests.
- Repeat tests.
- Display, print, or save test results.
- Temporarily suspend testing if an error is detected or terminate testing when a user-defined error limit is reached.
- View help messages that briefly describe each test and its parameters.
- View status messages that inform you if tests are completed successfully.
- View error messages that inform you of problems encountered during testing.

When to Use the System Diagnostics

If a major component or device in the system does not operate properly, component failure may be indicated. As long as the microprocessor and the system's input/output devices (monitor, keyboard, and diskette drive) are functioning, you can use the system diagnostics to help identify the problem.

Running the System Diagnostics

The system diagnostics is run from the utility partition on your hard drive.

�🄯 **NOTICE:** Use the system diagnostics to test only your system. Using this program with other systems may cause invalid results or error messages. In addition, use only the program that came with your system (or an updated version of that program).

 1 As the system boots, press <F10> during POST.

 2 From the utility partition main menu, select **Run System Diagnostics**, or select **Run Memory Diagnostics** if you are troubleshooting memory.

When you start the system diagnostics, a message is displayed stating that the diagnostics are initializing. Next, the **Diagnostics** menu appears. The menu allows you to run all or specific diagnostics tests or to exit the system diagnostics.

🖉 **NOTE:** Before you read the rest of this section, start the system diagnostics so that you can see the utility on your screen.

System Diagnostics Testing Options

Click the testing option in the **Main Menu** window. Table 5-1 provides a brief explanation of testing options.

Table 5-1.   System Diagnostics Testing Options

Testing Option	Function
Express Test	Performs a quick check of the system. This option runs device tests that do not require user interaction. Use this option to quickly identify the source of your problem.
Extended Test	Performs a more thorough check of the system. This test can take an hour or longer.
Custom Test	Tests a particular device.
Information	Displays test results.

Using the Custom Test Options

When you select **Custom Test** in the **Main Menu** window, the **Customize** window appears and allows you to select the device(s) to be tested, select specific options for testing, and view the test results.

Selecting Devices for Testing

The left side of the **Customize** window lists devices that can be tested. Devices are grouped by device type or by module, depending on the option you select. Click the (**+**) next to a device or module to view its components. Click (**+**) on any component to view the tests that are available. Clicking a device, rather than its components, selects all of the components of the device for testing.

Selecting Diagnostics Options

Use the **Diagnostics Options** area to select how you want to test a device. You can set the following options:

- **Non-Interactive Tests Only** — When checked, runs only tests that require no user intervention.
- **Quick Tests Only** — When checked, runs only the quick tests on the device. Extended tests will not run when you select this option.
- **Show Ending Timestamp** — When checked, time stamps the test log.
- **Test Iterations** — Selects the number of times the test is run.
- **Log output file pathname** — When checked, enables you to specify where the test log file is saved.

Viewing Information and Results

The tabs in the **Customize** window provide information about the test and the test results. The following tabs are available:

- **Results** — Displays the test that ran and the result.
- **Errors** — Displays any errors that occurred during the test.
- **Help** — Displays information about the currently selected device, component, or test.
- **Configuration** — Displays basic configuration information about the currently selected device.
- **Parameters** — If applicable, displays parameters that you can set for the test.

6

Jumpers and Connectors

This section provides specific information about the system jumpers and describes the connectors on the various boards in the system.

System Board Jumpers

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

Figure 6-1 shows the location of the configuration jumpers on the system board. Table 6-1 lists the jumper settings.

Figure 6-1. System Board Jumpers
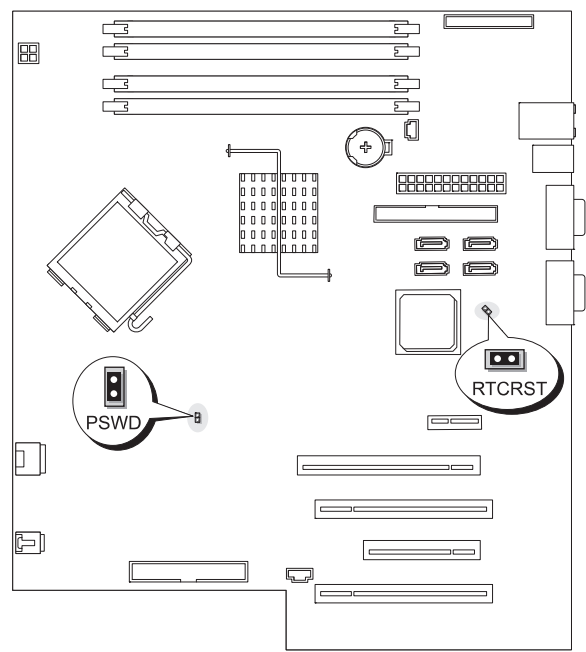
Table 6-1. System Board Jumper Settings

Jumper	Setting		Description
PSWD		(default)	The password feature is enabled.
			The password feature is disabled.
RTCRST		(default)	The configuration settings in NVRAM are retained at system boot.
			The configuration settings in NVRAM are cleared at next system boot.

System Board Connectors

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

See Figure 6-2 and Table 6-2 for the location and description of the system board connectors.

Figure 6-2.   System Board Connectors
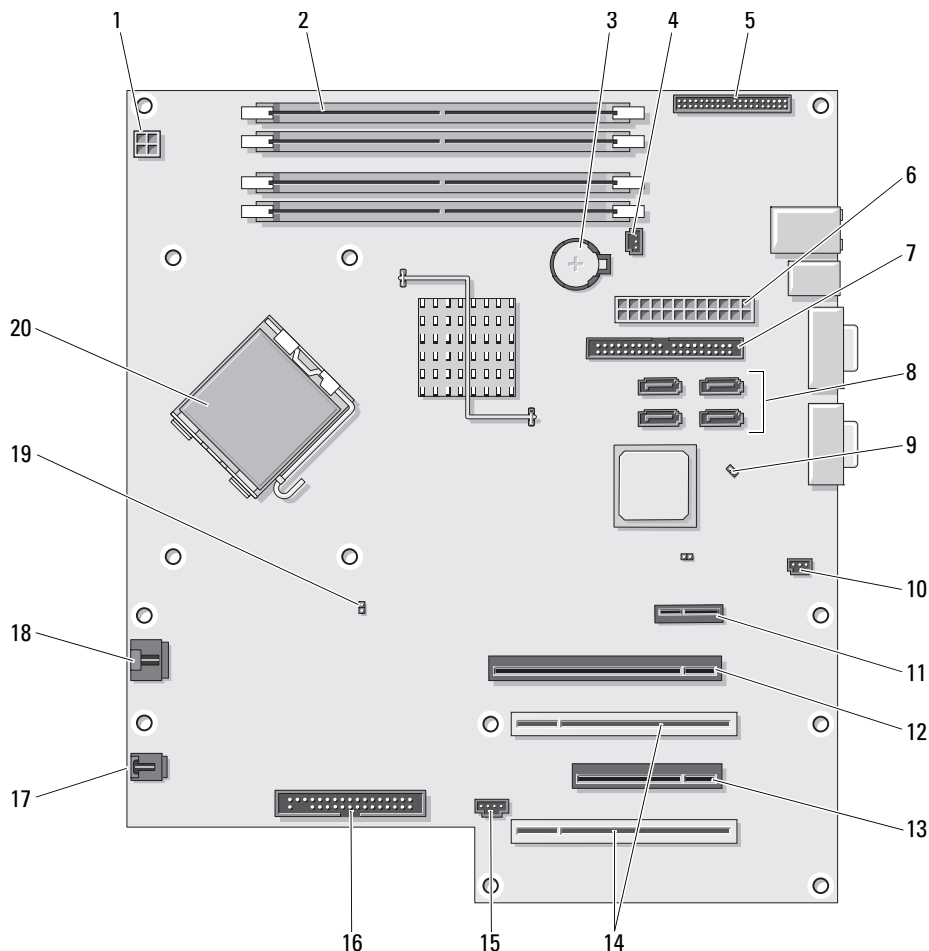
Table 6-2.   System Board Connectors

Item	Connector	Description
1	12VPOWER	power
2	DIMM_1, DIMM_2, DIMM_3, DIMM_4	memory modules
3	BATTERY	battery socket
4	FAN_MEM	memory fan
5	FRONTPANEL	front panel
6	POWER	main power
7	IDE	IDE drive
8	SATA0, SATA1, SATA2, SATA3	SATA drives
9	RTCRST	RTC reset jumper
10	INTRUDER	chassis intrusion header
11	SLOT1	PCIe x1
12	SLOT2	PCIe x8
13	SLOT4	PCIe x4
14	SLOT3, SLOT5	PCI
15	AUX_LED	auxiliary hard-drive LED
16	FLOPPY	diskette drive
17	FAN_CARD_CAGE	card cage fan
18	FAN_CPU	processor fan
19	PSWD	password jumper
20	CPU	processor

Disabling a Forgotten Password

The password jumper on the system board enables the system password features or disables them and clears any password(s) currently in use.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 41.

3 Move the PSWD jumper to the disabled position.

See Figure 6-1 to locate the password jumper on the system board.

4 Close the system. See "Closing the System" on page 41.

5 Reconnect the system to the electrical outlet, and turn on the system.

The existing passwords are not disabled (erased) until the system boots with the password jumper plug removed. However, before you assign a new system and/or setup password, you must install the jumper plug.

✎ **NOTE:** If you assign a new system and/or setup password with the jumper plug still removed, the system disables the new password(s) the next time it boots.

6 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

7 Open the system. See "Opening the System" on page 41.

8 Move the PSWD jumper from the disabled position to the enabled position.

9 Close the system, reconnect the system to the electrical outlet, and turn on the system.

10 Assign a new system and/or setup password.

To assign a new password using the System Setup program, see "Using the System Password" on page 35.

Getting Help

Obtaining Assistance

1 Complete the procedures in xx"Troubleshooting Your System."

2 Run the system diagnostics and record any information provided.

3 Make a copy of the Diagnostics Checklist (see "Diagnostics Checklist" on page 111), and fill it out.

4 Use Dell's extensive suite of online services available at Dell Support at **support.dell.com** for help with installation and troubleshooting procedures.

   For more information, see "Online Services" on page 107.

5 If the preceding steps have not resolved the problem, call Dell for technical assistance.

NOTE: Call technical support from a phone near or at the system so that technical support can assist you with any necessary procedures.

NOTE: Dell's Express Service Code system may not be available in all countries.

When prompted by Dell's automated telephone system, enter your Express Service Code to route the call directly to the proper support personnel. If you do not have an Express Service Code, open the **Dell Accessories** folder, double-click the **Express Service Code** icon, and follow the directions.

For instructions on using the technical support service, see "Support Service" on page 108 and "Before You Call" on page 110.

NOTE: Some of the following services are not always available in all locations outside the continental U.S. Call your local Dell representative for information on availability.

Online Services

You can access Dell Support at **support.dell.com**. Select your region on the **WELCOME TO DELL SUPPORT** page, and fill in the requested details to access help tools and information.

You can contact Dell electronically using the following addresses:

- World Wide Web

  www.dell.com/

  www.dell.com/ap/ (Asian/Pacific countries only)

  www.dell.com/jp (Japan only)

  www.euro.dell.com (Europe only)

www.dell.com/la (Latin American countries)

www.dell.ca (Canada only)

- Anonymous file transfer protocol (FTP)

  ftp.dell.com/

  Log in as user:anonymous, and use your e-mail address as your password.

- Electronic Support Service

  support@us.dell.com

  apsupport@dell.com (Asian/Pacific countries only)

  support.jp.dell.com (Japan only)

  support.euro.dell.com (Europe only)

- Electronic Quote Service

  apmarketing@dell.com (Asian/Pacific countries only)

  sales_canada@dell.com (Canada only)

AutoTech Service

Dell's automated support service—AutoTech—provides recorded answers to the questions most frequently asked by Dell customers about their portable and desktop computer systems.

When you call AutoTech, use your touch-tone telephone to select the subjects that correspond to your questions.

The AutoTech service is available 24 hours a day, 7 days a week. You can also access this service through the support service. See the contact information for your region.

Automated Order-Status Service

To check on the status of any Dell™ products that you have ordered, you can go to support.dell.com, or you can call the automated order-status service. A recording prompts you for the information needed to locate and report on your order. See the contact information for your region.

Support Service

Dell's support service is available 24 hours a day, 7 days a week, to answer your questions about Dell hardware. Our support staff use computer-based diagnostics to provide fast, accurate answers.

To contact Dell's support service, see "Before You Call" on page 110 and then see the contact information for your region.

Dell Enterprise Training and Certification

Dell Enterprise Training and Certification is available; see **www.dell.com/training** for more information. This service may not be offered in all locations.

Problems With Your Order

If you have a problem with your order, such as missing parts, wrong parts, or incorrect billing, contact Dell for customer assistance. Have your invoice or packing slip available when you call. See the contact information for your region.

Product Information

If you need information about additional products available from Dell, or if you would like to place an order, visit the Dell website at **www.dell.com**. For the telephone number to call to speak to a sales specialist, see the contact information for your region.

Returning Items for Warranty Repair or Credit

Prepare all items being returned, whether for repair or credit, as follows:

1 Call Dell to obtain a Return Material Authorization Number, and write it clearly and prominently on the outside of the box.

   For the telephone number to call, see the contact information for your region.

2 Include a copy of the invoice and a letter describing the reason for the return.

3 Include a copy of any diagnostic information, including the Diagnostics Checklist (see "Diagnostics Checklist" on page 111), indicating the tests you have run and any error messages reported by the system diagnostics.

4 Include any accessories that belong with the item(s) being returned (such as power cables, media such as CDs and diskettes, and guides) if the return is for credit.

5 Pack the equipment to be returned in the original (or equivalent) packing materials.

   You are responsible for paying shipping expenses. You are also responsible for insuring any product returned, and you assume the risk of loss during shipment to Dell. Collect-on-delivery (C.O.D.) packages are not accepted.

Returns that are missing any of the preceding requirements will be refused at our receiving dock and returned to you.

Before You Call

NOTE: Have your Express Service Code ready when you call. The code helps Dell's automated-support telephone system direct your call more efficiently.

Remember to fill out the Diagnostics Checklist (see "Diagnostics Checklist" on page 111). If possible, turn on your system before you call Dell for technical assistance and call from a telephone at or near the computer. You may be asked to type some commands at the keyboard, relay detailed information during operations, or try other troubleshooting steps possible only at the computer system itself. Ensure that the system documentation is available.

⚠ **CAUTION: Before servicing any components inside your computer, see your *Product Information Guide* for important safety information.**

Diagnostics Checklist

Name:

Date:

Address:

Phone number:

Service Tag (bar code on the back of the computer):

Express Service Code:

Return Material Authorization Number (if provided by Dell support technician):

Operating system and version:

Peripherals:

Expansion cards:

Are you connected to a network? Yes No

Network, version, and network card:

Programs and versions:

See your operating system documentation to determine the contents of the system's start-up files. If possible, print each file. Otherwise, record the contents of each file before calling Dell.

Error message, beep code, or diagnostic code:

Description of problem and troubleshooting procedures you performed:

Contacting Dell

To contact Dell electronically, you can access the following websites:

- www.dell.com
- support.dell.com (support)

For specific web addresses for your country, find the appropriate country section in the table below.

NOTE: Toll-free numbers are for use within the country for which they are listed.

NOTE: In certain countries, support specific to Dell™ XPS™ computers is available at a separate telephone number listed for participating countries. If you do not see a telephone number listed that is specific for XPS computers, you may contact Dell through the support number listed and your call will be routed appropriately.

When you need to contact Dell, use the electronic addresses, telephone numbers, and codes provided in the following table. If you need assistance in determining which codes to use, contact a local or an international operator.

NOTE: The contact information provided was deemed correct at the time that this document went to print and is subject to change.

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Anguilla	Website: www.dell.com.ai	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 800-335-0031
Antigua and Barbuda	Website: www.dell.com.ag	
	E-mail: la-techsupport@dell.com	
	General Support	1-800-805-5924
Argentina (Buenos Aires)	Website: www.dell.com.ar	
International Access Code: 00	E-mail: la-techsupport@dell.com	
Country Code: 54	E-mail for desktop and portable computers: la-techsupport@dell.com	
City Code: 11	E-mail for servers and EMC® storage products: la_enterprise@dell.com	
	Customer Care	toll-free: 0-800-444-0730
	Technical Support	toll-free: 0-800-444-0733
	Technical Support Services	toll-free: 0-800-444-0724
	Sales	0-810-444-3355

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Aruba	Website: www.dell.com.aw	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 800-1578
Australia (Sydney)	Website: support.ap.dell.com	
International Access Code: 0011	E-mail: support.ap.dell.com/contactus	
Country Code: 61	General Support	13DELL-133355
City Code: 2		
Austria (Vienna)	Website: support.euro.dell.com	
International Access Code: 900	E-mail: tech_support_central_europe@dell.com	
Country Code: 43	Home/Small Business Sales	0820 240 530 00
City Code: 1	Home/Small Business Fax	0820 240 530 49
	Home/Small Business Customer Care	0820 240 530 14
	Preferred Accounts/Corporate Customer Care	0820 240 530 16
	Support for XPS	0820 240 530 81
	Home/Small Business Support for all other Dell computers	0820 240 530 17
	Preferred Accounts/Corporate Support	0820 240 530 17
	Switchboard	0820 240 530 00
Bahamas	Website: www.dell.com.bs	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-866-278-6818
Barbados	Website: www.dell.com/bb	
	E-mail: la-techsupport@dell.com	
	General Support	1-800-534-3142

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Belgium (Brussels)	Website: **support.euro.dell.com**	
International Access Code: **00**	Tech Support for XPS	02 481 92 96
Country Code: **32**	Tech Support for all other Dell computers	02 481 92 88
City Code: **2**	Tech Support Fax	02 481 92 95
	Customer Care	02 713 15 65
	Corporate Sales	02 481 91 00
	Fax	02 481 92 99
	Switchboard	02 481 91 00
Bermuda	Website: www.dell.com/bm	
	E-mail: la-techsupport@dell.com	
	General Support	1-877-890-0751
Bolivia	Website: www.dell.com/bo	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 800-10-0238
Brazil	Website: **www.dell.com/br**	
International Access Code: **00**	E-mail: la-techsupport@dell.com	
Country Code: **55**	Customer Support, Tech Support	0800 90 3355
City Code: **51**	Technical Support Fax	51 3481 5470
	Customer Care Fax	51 3481 5480
	Sales	0800 90 3390
British Virgin Islands	General Support	toll-free: 1-866-278-6820
Brunei	Technical Support (Penang, Malaysia)	604 633 4966
Country Code: **673**	Customer Care (Penang, Malaysia)	604 633 4888
	Transaction Sales (Penang, Malaysia)	604 633 4955

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Canada (North York, Ontario)	Online Order Status: **www.dell.ca/ostatus**	
International Access Code: **011**	AutoTech (automated Hardware and Warranty Support)	toll-free: 1-800-247-9362
	Customer Service (Home Sales/Small Business)	toll-free: 1-800-847-4096
	Customer Service (med./large business, government)	toll-free: 1-800-326-9463
	Customer Service (printers, projectors, televisions, handhelds, digital jukebox, and wireless)	toll-free: 1-800-847-4096
	Hardware Warranty Support (Home Sales/Small Business)	toll-free: 1-800-906-3355
	Hardware Warranty Support (med./large bus., government)	toll-free: 1-800-387-5757
	Hardware Warranty Support (printers, projectors, televisions, handhelds, digital jukebox, and wireless)	1-877-335-5767
	Sales (Home Sales/Small Business)	toll-free: 1-800-387-5752
	Sales (med./large bus., government)	toll-free: 1-800-387-5755
	Spare Parts Sales & Extended Service Sales	1 866 440 3355
Cayman Islands	E-mail: la-techsupport@dell.com	
	General Support	1-877-262-5415
Chile (Santiago)	Website: **www.dell.com/cl**	
Country Code: **56**	E-mail: la-techsupport@dell.com	
City Code: **2**	Sales and Customer Support	toll-free: 1230-020-4823

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
China (Xiamen)	Technical Support website: **support.dell.com.cn**	
Country Code: **86**	Technical Support E-mail: cn_support@dell.com	
City Code: **592**	Customer Care E-mail: customer_cn@dell.com	
	Technical Support Fax	592 818 1350
	Technical Support (Dell™ Dimension™ and Inspiron)	toll-free: 800 858 2968
	Technical Support (OptiPlex™, Latitude™, and Dell Precision™)	toll-free: 800 858 0950
	Technical Support (servers and storage)	toll-free: 800 858 0960
	Technical Support (projectors, PDAs, switches, routers, and so on)	toll-free: 800 858 2920
	Technical Support (printers)	toll-free: 800 858 2311
	Customer Care	toll-free: 800 858 2060
	Customer Care Fax	592 818 1308
	Home and Small Business	toll-free: 800 858 2222
	Preferred Accounts Division	toll-free: 800 858 2557
	Large Corporate Accounts GCP	toll-free: 800 858 2055
	Large Corporate Accounts Key Accounts	toll-free: 800 858 2628
	Large Corporate Accounts North	toll-free: 800 858 2999
	Large Corporate Accounts North Government and Education	toll-free: 800 858 2955
	Large Corporate Accounts East	toll-free: 800 858 2020
	Large Corporate Accounts East Government and Education	toll-free: 800 858 2669
	Large Corporate Accounts Queue Team	toll-free: 800 858 2572
	Large Corporate Accounts South	toll-free: 800 858 2355
	Large Corporate Accounts West	toll-free: 800 858 2811
	Large Corporate Accounts Spare Parts	toll-free: 800 858 2621
Colombia	Website: **www.dell.com/cl**	
	E-mail: la-techsupport@dell.com	
	General Support	01-800-915-4755

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Costa Rica	Website: www.dell.com/cr	
	E-mail: la-techsupport@dell.com	
	General Support	0800-012-0231
Czech Republic (Prague)	Website: support.euro.dell.com	
International Access Code: 00	E-mail: czech_dell@dell.com	
Country Code: 420	Technical Support	22537 2727
	Customer Care	22537 2707
	Fax	22537 2714
	Technical Fax	22537 2728
	Switchboard	22537 2711
Denmark (Copenhagen)	Website: support.euro.dell.com	
International Access Code: 00	Technical Support for XPS	7010 0074
Country Code: 45	Technical Support for all other Dell computers	7023 0182
	Customer Care (Relational)	7023 0184
	Home/Small Business Customer Care	3287 5505
	Switchboard (Relational)	3287 1200
	Switchboard Fax (Relational)	3287 1201
	Switchboard (Home/Small Business)	3287 5000
	Switchboard Fax (Home/Small Business)	3287 5001
Dominica	Website: www.dell.com/dm	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-866-278-6821
Dominican Republic	Website: www.dell.com/do	
	E-mail: la-techsupport@dell.com	
	General Support	1-800-156-1588
Ecuador	Website: www.dell.com/ec	
	E-mail: la-techsupport@dell.com	
	General Support (calling from Quito)	toll-free: 999-119-877-655-3355
	General Support (calling from Guayaquil)	toll-free: 1800-999-119-877-655-3355

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
El Salvador	Website: **www.dell.com/ec**	
	E-mail: la-techsupport@dell.com	
	General Support	800-6132
Finland (Helsinki)	Website: **support.euro.dell.com**	
International Access Code: **990**	E-mail: fi_support@dell.com	
Country Code: **358**	Technical Support	0207 533 555
City Code: **9**	Customer Care	0207 533 538
	Switchboard	0207 533 533
	Sales under 500 employees	0207 533 540
	Fax	0207 533 530
	Sales over 500 employees	0207 533 533
	Fax	0207 533 530
France (Paris) (Montpellier)	Website: **support.euro.dell.com**	
International Access Code: **00**	**Home and Small Business**	
Country Code: **33**	Technical Support for XPS	0825 387 129
City Codes: **(1) (4)**	Technical Support for all other Dell computers	0825 387 270
	Customer Care	0825 823 833
	Switchboard	0825 004 700
	Switchboard (calls from outside of France)	04 99 75 40 00
	Sales	0825 004 700
	Fax	0825 004 701
	Fax (calls from outside of France)	04 99 75 40 01
	Corporate	
	Technical Support	0825 004 719
	Customer Care	0825 338 339
	Switchboard	01 55 94 71 00
	Sales	01 55 94 71 00
	Fax	01 55 94 71 01

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Germany (Frankfurt)	Website: **support.euro.dell.com**	
International Access Code: **00**	E-mail: tech_support_central_europe@dell.com	
Country Code: **49**	Technical Support for XPS	069 9792 7222
City Code: **69**	Technical Support for all other Dell computers	069 9792-7200
	Home/Small Business Customer Care	0180-5-224400
	Global Segment Customer Care	069 9792-7320
	Preferred Accounts Customer Care	069 9792-7320
	Large Accounts Customer Care	069 9792-7320
	Public Accounts Customer Care	069 9792-7320
	Switchboard	069 9792-7000
Greece	Website: **support.euro.dell.com**	
International Access Code: **00**	Technical Support	00800-44 14 95 18
Country Code: **30**	Gold Service Technical Support	00800-44 14 00 83
	Switchboard	2108129810
	Gold Service Switchboard	2108129811
	Sales	2108129800
	Fax	2108129812
Grenada	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-866-540-3355
Guatemala	E-mail: la-techsupport@dell.com	
	General Support	1-800-999-0136
Guyana	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-877-270-4609

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Hong Kong	Website: support.ap.dell.com	
International Access Code: **001**	Technical Support E-mail: HK_support@Dell.com	
Country Code: **852**	Technical Support (Dimension and Inspiron)	2969 3188
	Technical Support (OptiPlex, Latitude, and Dell Precision)	2969 3191
	Technical Support (PowerApp™, PowerEdge™, PowerConnect™, and PowerVault™)	2969 3196
	Customer Care	3416 0910
	Large Corporate Accounts	3416 0907
	Global Customer Programs	3416 0908
	Medium Business Division	3416 0912
	Home and Small Business Division	2969 3105
India	E-mail: india_support_desktop@dell.com india_support_notebook@dell.com india_support_Server@dell.com	
	Technical Support	1600338045 and 1600448046
	Sales (Large Corporate Accounts)	1600 33 8044
	Sales (Home and Small Business)	1600 33 8046

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Ireland (Cherrywood)	Website: **support.euro.dell.com**	
International Access Code: **00**	E-mail: dell_direct_support@dell.com	
Country Code: **353**	**Sales**	
City Code: **1**	Ireland Sales	01 204 4444
	Dell Outlet	1850 200 778
	Online Ordering HelpDesk	1850 200 778
	Customer Care	
	Home User Customer Care	01 204 4014
	Small Business Customer Care	01 204 4014
	Corporate Customer Care	1850 200 982
	Technical Support	
	Technical Support for XPS computers only	1850 200 722
	Technical Support for all other Dell computers	1850 543 543
	General	
	Fax/Sales Fax	01 204 0103
	Switchboard	01 204 4444
	U.K. Customer Care (dial within U.K. only)	0870 906 0010
	Corporate Customer Care (dial within U.K. only)	0870 907 4499
	U.K. Sales (dial within U.K. only)	0870 907 4000
Italy (Milan)	Website: **support.euro.dell.com**	
International Access Code: **00**	**Home and Small Business**	
Country Code: **39**	Technical Support	02 577 826 90
City Code: **02**	Customer Care	02 696 821 14
	Fax	02 696 821 13
	Switchboard	02 696 821 12
	Corporate	
	Technical Support	02 577 826 90
	Customer Care	02 577 825 55
	Fax	02 575 035 30
	Switchboard	02 577 821

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Jamaica	E-mail: la-techsupport@dell.com	
	General Support (dial from within Jamaica only)	1-800-440-9205
Japan (Kawasaki)	Website: **support.jp.dell.com**	
International Access Code: **001**	Technical Support (servers)	toll-free: 0120-198-498
Country Code: **81**	Technical Support outside of Japan (servers)	81-44-556-4162
City Code: **44**	Technical Support (Dimension and Inspiron)	toll-free: 0120-198-226
	Technical Support outside of Japan (Dimension and Inspiron)	81-44-520-1435
	Technical Support (Dell Precision, OptiPlex, and Latitude)	toll-free:0120-198-433
	Technical Support outside of Japan (Dell Precision, OptiPlex, and Latitude)	81-44-556-3894
	Technical Support (PDAs, projectors, printers, routers)	toll-free: 0120-981-690
	Technical Support outside of Japan (PDAs, projectors, printers, routers)	81-44-556-3468
	Faxbox Service	044-556-3490
	24-Hour Automated Order Status Service	044-556-3801
	Customer Care	044-556-4240
	Business Sales Division (up to 400 employees)	044-556-1465
	Preferred Accounts Division Sales (over 400 employees)	044-556-3433
	Public Sales (government agencies, educational institutions, and medical institutions)	044-556-5963
	Global Segment Japan	044-556-3469
	Individual User	044-556-1760
	Switchboard	044-556-4300

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Korea (Seoul)	E-mail: krsupport@dell.com	
International Access Code: **001**	Support	toll-free: 080-200-3800
Country Code: **82**	Support (Dimension, PDA, Electronics and Accessories)	toll-free: 080-200-3801
City Code: **2**	Sales	toll-free: 080-200-3600
	Fax	2194-6202
	Switchboard	2194-6000
Latin America	Customer Technical Support (Austin, Texas, U.S.A.)	512 728-4093
	Customer Service (Austin, Texas, U.S.A.)	512 728-3619
	Fax (Technical Support and Customer Service) (Austin, Texas, U.S.A.)	512 728-3883
	Sales (Austin, Texas, U.S.A.)	512 728-4397
	SalesFax (Austin, Texas, U.S.A.)	512 728-4600
		or 512 728-3772
Luxembourg	Website: **support.euro.dell.com**	
International Access Code: **00**	Support	342 08 08 075
Country Code: **352**	Home/Small Business Sales	+32 (0)2 713 15 96
	Corporate Sales	26 25 77 81
	Customer Care	+32 (0)2 481 91 19
	Fax	26 25 77 82
Macao	Technical Support	toll-free: 0800 105
Country Code: **853**	Customer Service (Xiamen, China)	34 160 910
	Transaction Sales (Xiamen, China)	29 693 115

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Malaysia (Penang)	Website: **support.ap.dell.com**	
International Access Code: **00**	Technical Support (Dell Precision, OptiPlex, and Latitude)	toll-free: 1 800 880 193
Country Code: **60**	Technical Support (Dimension, Inspiron, and Electronics and Accessories)	toll-free: 1 800 881 306
City Code: **4**	Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault)	toll-free: 1800 881 386
	Customer Care	toll-free: 1800 881 306 (option 6)
	Transaction Sales	toll-free: 1 800 888 202
	Corporate Sales	toll-free: 1 800 888 213
Mexico	E-mail: la-techsupport@dell.com	
International Access Code: **00**	Customer Technical Support	001-877-384-8979
Country Code: **52**		or 001-877-269-3383
	Sales	50-81-8800
		or 01-800-888-3355
	Customer Service	001-877-384-8979
		or 001-877-269-3383
	Main	50-81-8800
		or 01-800-888-3355
Montserrat	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-866-278-6822
Netherlands Antilles	E-mail: la-techsupport@dell.com	
	General Support	001-800-882-1519

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Netherlands (Amsterdam)	Website: **support.euro.dell.com**	
International Access Code: **00**	Technical Support for XPS	020 674 45 94
Country Code: **31**	Technical Support for all other Dell computers	020 674 45 00
City Code: **20**	Technical Support Fax	020 674 47 66
	Home/Small Business Customer Care	020 674 42 00
	Relational Customer Care	020 674 4325
	Home/Small Business Sales	020 674 55 00
	Relational Sales	020 674 50 00
	Home/Small Business Sales Fax	020 674 47 75
	Relational Sales Fax	020 674 47 50
	Switchboard	020 674 50 00
	Switchboard Fax	020 674 47 50
New Zealand	Website: **support.ap.dell.com**	
International Access Code: **00**	E-mail: support.ap.dell.com/contactus	
Country Code: **64**	General Support	0800 441 567
Nicaragua	E-mail: la-techsupport@dell.com	
	General Support	001-800-220-1377
Norway (Lysaker)	Website: **support.euro.dell.com**	
International Access Code: **00**	Technical Support for XPS	815 35 043
Country Code: **47**	Technical Support for all other Dell products	671 16882
	Relational Customer Care	671 17575
	Home/Small Business Customer Care	23162298
	Switchboard	671 16800
	Fax Switchboard	671 16865
Panama	E-mail: la-techsupport@dell.com	
	General Support	011-800-507-1264
Peru	E-mail: la-techsupport@dell.com	
	General Support	0800-50-669

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Poland (Warsaw)	Website: **support.euro.dell.com**	
International Access Code: **011**	E-mail: pl_support_tech@dell.com	
Country Code: **48**	Customer Service Phone	57 95 700
City Code: **22**	Customer Care	57 95 999
	Sales	57 95 999
	Customer Service Fax	57 95 806
	Reception Desk Fax	57 95 998
	Switchboard	57 95 999
Portugal	Website: **support.euro.dell.com**	
International Access Code: **00**	Technical Support	707200149
Country Code: **351**	Customer Care	800 300 413
	Sales	800 300 410 or 800 300 411 or 800 300 412 or 21 422 07 10
	Fax	21 424 01 12
Puerto Rico	E-mail: la-techsupport@dell.com	
	General Support	1-877-537-3355
St. Kitts and Nevis	Website: **www.dell.com/kn**	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-866-540-3355
St. Lucia	Website: **www.dell.com/lc**	
	E-mail: la-techsupport@dell.com	
	General Support	1-800-882-1521
St. Vincent and the Grenadines	Website: **www.dell.com/vc**	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-877-441-4740

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Singapore (Singapore) International Access Code: **005** Country Code: **65**	**NOTE:** The phone numbers in this section should be called from within Singapore or Malaysia only.	
	Website: **support.ap.dell.com**	
	Technical Support (Dimension, Inspiron, and Electronics and Accessories)	toll-free: 1 800 394 7430
	Technical Support (OptiPlex, Latitude, and Dell Precision)	toll-free: 1 800 394 7488
	Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault)	toll-free: 1 800 394 7478
	Customer Care	toll-free: 1 800 394 7430 (option 6)
	Transaction Sales	toll-free: 1 800 394 7412
	Corporate Sales	toll-free: 1 800 394 7419
Slovakia (Prague) International Access Code: **00** Country Code: **421**	Website: **support.euro.dell.com**	
	E-mail: czech_dell@dell.com	
	Technical Support	02 5441 5727
	Customer Care	420 22537 2707
	Fax	02 5441 8328
	Tech Fax	02 5441 8328
	Switchboard (Sales)	02 5441 7585
South Africa (Johannesburg) International Access Code: **09/091** Country Code: **27** City Code: **11**	Website: **support.euro.dell.com**	
	E-mail: dell_za_support@dell.com	
	Gold Queue	011 709 7713
	Technical Support	011 709 7710
	Customer Care	011 709 7707
	Sales	011 709 7700
	Fax	011 706 0495
	Switchboard	011 709 7700
Southeast Asian and Pacific Countries	Technical Support, Customer Service, and Sales (Penang, Malaysia)	604 633 4810

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Spain (Madrid)	Website: **support.euro.dell.com**	
International Access Code: **00**	**Home and Small Business**	
Country Code: **34**	Technical Support	902 100 130
City Code: **91**	Customer Care	902 118 540
	Sales	902 118 541
	Switchboard	902 118 541
	Fax	902 118 539
	Corporate	
	Technical Support	902 100 130
	Customer Care	902 115 236
	Switchboard	91 722 92 00
	Fax	91 722 95 83
Sweden (Upplands Vasby)	Website: **support.euro.dell.com**	
International Access Code: **00**	Technical Support for XPS	0771 340 340
Country Code: **46**	Technical Support for all other Dell products	08 590 05 199
City Code: **8**	Relational Customer Care	08 590 05 642
	Home/Small Business Customer Care	08 587 70 527
	Employee Purchase Program (EPP) Support	020 140 14 44
	Technical Support Fax	08 590 05 594
	Sales	08 590 05 185
Switzerland (Geneva)	Website: **support.euro.dell.com**	
International Access Code: **00**	E-mail: Tech_support_central_Europe@dell.com	
Country Code: **41**	Technical Support for XPS	0848 33 88 57
City Code: **22**	Technical Support (Home and Small Business) for all other Dell products	0844 811 411
	Technical Support (Corporate)	0844 822 844
	Customer Care (Home and Small Business)	0848 802 202
	Customer Care (Corporate)	0848 821 721
	Fax	022 799 01 90
	Switchboard	022 799 01 01

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Taiwan International Access Code: **002** Country Code: **886**	Website: **support.ap.dell.com**	
	E-mail: ap_support@dell.com	
	Technical Support (OptiPlex, Latitude, Inspiron, Dimension, and Electronics and Accessories)	toll-free: 00801 86 1011
	Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault)	toll-free: 00801 60 1256
	Customer Care	toll-free: 00801 60 1250 (option 5)
	Transaction Sales	toll-free: 00801 65 1228
	Corporate Sales	toll-free: 00801 651 227
Thailand International Access Code: **001** Country Code: **66**	Website: **support.ap.dell.com**	
	Technical Support (OptiPlex, Latitude, and Dell Precision)	toll-free: 1800 0060 07
	Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault)	toll-free: 1800 0600 09
	Customer Care	toll-free: 1800 006 007 (option 7)
	Corporate Sales	toll-free: 1800 006 009
	Transaction Sales	toll-free: 1800 006 006
Trinidad/Tobago	Website: **www.dell.com/tt**	
	E-mail: la-techsupport@dell.com	
	General Support	1-800-805-8035
Turks and Caicos Islands	Website: **www.dell.com/tc**	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-877-441-4735

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
U.K. (Bracknell)	Website: **support.euro.dell.com**	
International Access Code: **00**	E-mail: dell_direct_support@dell.com	
Country Code: **44**	Customer Care website:	
City Code: **1344**	**support.euro.dell.com/uk/en/ECare/form/home.asp**	
	Sales	
	Home and Small Business Sales	0870 907 4000
	Corporate/Public Sector Sales	01344 860 456
	Customer Care	
	Home and Small Business Customer Care	0870 906 0010
	Corporate Customer Care	01344 373 185
	Preferred Accounts (500–5000 employees)	0870 906 0010
	Global Accounts Customer Care	01344 373 186
	Central Government Customer Care	01344 373 193
	Local Government & Education Customer Care	01344 373 199
	Health Customer Care	01344 373 194
	Technical Support	
	Technical Support for XPS computers only	0870 366 4180
	Technical Support (Corporate/Preferred Accounts/PAD [1000+ employees])	0870 908 0500
	Technical Support for all other products	0870 353 0800
	General	
	Home and Small Business Fax	0870 907 4006
Uruguay	Website: **www.dell.com/uy**	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 000-413-598-2521

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
U.S.A. (Austin, Texas)	Automated Order-Status Service	toll-free: 1-800-433-9014
International Access Code: 011	AutoTech (portable and desktop computers)	toll-free: 1-800-247-9362
Country Code: 1	Hardware and Warranty Support (Dell **TV, Printers, and Projectors**) for Relationship customers	toll-free: 1-877-459-7298
	Americas Consumer XPS Support	toll-free: 1-800-232-8544
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	E-mail: la-techsupport@dell.com	
	General Support	0800-100-4752

Glossary

This section defines or identifies technical terms, abbreviations, and acronyms used in your system documents.

A — Ampere(s).

AC — Alternating current.

ACPI — Advanced Configuration and Power Interface. A standard interface for enabling the operating system to direct configuration and power management.

ambient temperature — The temperature of the area or room where the system is located.

ANSI — American National Standards Institute. The primary organization for developing technology standards in the U.S.

application — Software designed to help you perform a specific task or series of tasks. Applications run from the operating system.

ASCII — American Standard Code for Information Interchange.

asset tag — An individual code assigned to a system, usually by an administrator, for security or tracking purposes.

backup — A copy of a program or data file. As a precaution, back up your system's hard drive on a regular basis. Before making a change to the configuration of your system, back up important start-up files from your operating system.

backup battery — A battery that maintains system configuration, date, and time information in a special section of memory when the system is turned off.

beep code — A diagnostic message in the form of a pattern of beeps from your system's speaker. For example, one beep, followed by a second beep, and then a burst of three beeps is beep code 1-1-3.

BIOS — Basic input/output system. Your system's BIOS contains programs stored on a flash memory chip. The BIOS controls the following:
- Communications between the processor and peripheral devices
- Miscellaneous functions, such as system messages

bit — The smallest unit of information interpreted by your system.

blade — A module that contains a processor, memory, and a hard drive. The modules are mounted into a chassis that includes power supplies and fans.

BMC — Baseboard management controller.

boot routine — A program that clears all memory, initializes devices, and loads the operating system when you start your system. Unless the operating system fails to respond, you can reboot (also called *warm boot*) your system by pressing <Ctrl><Alt><Del>. Otherwise, you must restart the system by pressing the reset button or by turning the system off and then back on.

bootable diskette — A diskette that is used to start your system if the system will not boot from the hard drive.

BTU — British thermal unit.

bus — An information pathway between the components of a system. Your system contains an expansion bus that allows the processor to communicate with controllers for the peripheral devices connected to the system. Your system also contains an address bus and a data bus for communications between the processor and RAM.

C — Celsius.

cache — A fast storage area that keeps a copy of data or instructions for quick data retrieval. When a program makes a request to a disk drive for data that is in the cache, the disk-cache utility can retrieve the data from RAM faster than from the disk drive.

CD — Compact disc. CD drives use optical technology to read data from CDs.

cm — Centimeter(s).

cmos — Complementary metal-oxide semiconductor.

component — As they relate to DMI, components include operating systems, computer systems, expansion cards, and peripherals that are compatible with DMI. Each component is made up of groups and attributes that are defined as relevant to that component.

COM*n* — The device names for the serial ports on your system.

control panel — The part of the system that contains indicators and controls, such as the power button and power indicator.

controller — A chip that controls the transfer of data between the processor and memory or between the processor and a peripheral.

conventional memory — The first 640 KB of RAM. Conventional memory is found in all systems. Unless they are specially designed, MS-DOS® programs are limited to running in conventional memory.

coprocessor — A chip that relieves the system's processor of specific processing tasks. A math coprocessor, for example, handles numeric processing.

CPU — Central processing unit. See *processor*.

DC — Direct current.

DDR — Double-data rate. A technology in memory modules that potentially doubles the output.

device driver — A program that allows the operating system or some other program to interface correctly with a peripheral. Some device drivers—such as network drivers—must be loaded from the **config.sys** file or as memory-resident programs (usually, from the **autoexec.bat** file). Others must load when you start the program for which they were designed.

DHCP — Dynamic Host Configuration Protocol. A method of automatically assigning an IP address to a client system.

diagnostics — A comprehensive set of tests for your system.

DIMM — Dual in-line memory module. See also *memory module*.

DIN — *Deutsche Industrie Norm*.

directory — Directories help keep related files organized on a disk in a hierarchical, "inverted tree" structure. Each disk has a "root" directory. Additional directories that branch off the root directory are called *subdirectories*. Subdirectories may contain additional directories branching off them.

DMA — Direct memory access. A DMA channel allows certain types of data transfer between RAM and a device to bypass the processor.

DMI — Desktop Management Interface. DMI enables the management of your system's software and hardware by collecting information about the system's components, such as the operating system, memory, peripherals, expansion cards, and asset tag.

DNS — Domain Name System. A method of translating Internet domain names, such as **www.dell.com**, into IP addresses, such as 143.166.83.200.

DRAM — Dynamic random-access memory. A system's RAM is usually made up entirely of DRAM chips.

DVD — Digital versatile disc.

ECC — Error checking and correction.

EEPROM — Electronically erasable programmable read-only memory.

EMC — Electromagnetic compatibility.

EMI — Electromagnetic interference.

ERA — Embedded remote access. ERA allows you to perform remote, or "out-of-band," server management on your network server using a remote access controller.

ESD — Electrostatic discharge.

ESM — Embedded server management.

expansion bus — Your system contains an expansion bus that allows the processor to communicate with controllers for peripherals, such as NICs.

expansion card — An add-in card, such as a NIC or SCSI adapter, that plugs into an expansion-card connector on the system board. An expansion card adds some specialized function to the system by providing an interface between the expansion bus and a peripheral.

expansion-card connector — A connector on the system board or riser board for plugging in an expansion card.

F — Fahrenheit.

FAT — File allocation table. The file system structure used by MS-DOS to organize and keep track of file storage. The Microsoft® Windows® operating systems can optionally use a FAT file system structure.

flash memory — A type of EEPROM chip that can be reprogrammed from a utility on diskette while still installed in a system; most EEPROM chips can only be rewritten with special programming equipment.

format — To prepare a hard drive or diskette for storing files. An unconditional format deletes all data stored on the disk.

FSB — Front-side bus. The FSB is the data path and physical interface between the processor and the main memory (RAM).

ft — Feet.

FTP — File transfer protocol.

g — Gram(s).

G — Gravities.

Gb — Gigabit(s); 1024 megabits or 1,073,741,824 bits.

GB — Gigabyte(s); 1024 megabytes or 1,073,741,824 bytes. However, when referring to hard-drive capacity, the term is usually rounded to 1,000,000,000 bytes.

graphics mode — A video mode that can be defined as *x* horizontal by *y* vertical pixels by *z* colors.

group — As it relates to DMI, a group is a data structure that defines common information, or attributes, about a manageable component.

guarding — A type of data redundancy in which a set of physical drives stores data and an additional drive stores parity data. See also *mirroring*, *striping*, and *RAID*.

h — Hexadecimal. A base-16 numbering system, often used in programming to identify addresses in the system's RAM and I/O memory addresses for devices. In text, hexadecimal numbers are often followed by *h*.

headless system — A system or device that functions without having a keyboard, mouse, or monitor attached. Normally, headless systems are managed over a network using an Internet browser.

host adapter — A host adapter implements communication between the system's bus and the controller for a peripheral device. (Hard-drive controller subsystems include integrated host adapter circuitry.) To add a SCSI expansion bus to your system, you must install or connect the appropriate host adapter.

Hz — Hertz.

I/O — Input/output. A keyboard is an input device, and a monitor is an output device. In general, I/O activity can be differentiated from computational activity.

ID — Identification.

IDE — Integrated drive electronics. A standard interface between the system board and storage devices.

integrated mirroring — Provides simultaneous physical mirroring of two drives. Integrated mirroring functionality is provided by the system's hardware. See also *mirroring*.

internal processor cache — An instruction and data cache built into the processor.

IP — Internet Protocol.

IPX — Internet package exchange.

IRQ — Interrupt request. A signal that data is about to be sent to or received by a peripheral device travels by an IRQ line to the processor. Each peripheral connection must be assigned an IRQ number. Two devices can share the same IRQ assignment, but you cannot operate both devices simultaneously.

jumper — Small blocks on a circuit board with two or more pins emerging from them. Plastic plugs containing a wire fit down over the pins. The wire connects the pins and creates a circuit, providing a simple and reversible method of changing the circuitry in a board.

K — Kilo-; 1000.

Kb — Kilobit(s); 1024 bits.

KB — Kilobyte(s); 1024 bytes.

Kbps — Kilobit(s) per second.

KBps — Kilobyte(s) per second.

key combination — A command requiring you to press multiple keys at the same time (for example, <Ctrl><Alt><Del>).

kg — Kilogram(s); 1000 grams.

kHz — Kilohertz.

KMM — Keyboard/monitor/mouse.

KVM — Keyboard/video/mouse. KVM refers to a switch that allows selection of the system from which the video is displayed and for which the keyboard and mouse are used.

LAN — Local area network. A LAN is usually confined to the same building or a few nearby buildings, with all equipment linked by wiring dedicated specifically to the LAN.

lb — Pound(s).

LCD — Liquid crystal display.

LED — Light-emitting diode. An electronic device that lights up when a current is passed through it.

Linux — A UNIX-like operating system that runs on a variety of hardware systems. Linux is open source software, which is freely available; however, the full distribution of Linux along with technical support and training are available for a fee from vendors such as Red Hat Software.

local bus — On a system with local-bus expansion capability, certain peripheral devices (such as the video adapter circuitry) can be designed to run much faster than they would with a traditional expansion bus. See also *bus*.

LVD — Low voltage differential.

m — Meter(s).

mA — Milliampere(s).

MAC address — Media Access Control address. Your system's unique hardware number on a network.

mAh — Milliampere-hour(s).

Mb — Megabit(s); 1,048,576 bits.

MB — Megabyte(s); 1,048,576 bytes. However, when referring to hard-drive capacity, the term is often rounded to mean 1,000,000 bytes.

Mbps — Megabits per second.

MBps — Megabytes per second.

MBR — Master boot record.

memory address — A specific location, usually expressed as a hexadecimal number, in the system's RAM.

memory module — A small circuit board containing DRAM chips that connects to the system board.

memory — An area in your system that stores basic system data. A system can contain several different forms of memory, such as integrated memory (ROM and RAM) and add-in memory modules (DIMMs).

MHz — Megahertz.

mirroring — A type of data redundancy in which a set of physical drives stores data and one or more sets of additional drives stores duplicate copies of the data. Mirroring functionality is provided by software. See also *guarding*, *integrated mirroring*, *striping*, and *RAID*.

mm — Millimeter(s).

ms — Millisecond(s).

MS-DOS® — Microsoft Disk Operating System.

NAS — Network Attached Storage. NAS is one of the concepts used for implementing shared storage on a network. NAS systems have their own operating systems, integrated hardware, and software that are optimized to serve specific storage needs.

NIC — Network interface controller. A device that is installed or integrated in a system to allow connection to a network.

NMI — Nonmaskable interrupt. A device sends an NMI to signal the processor about hardware errors.

ns — Nanosecond(s).

NTFS — The NT File System option in the Windows 2000 operating system.

NVRAM — Nonvolatile random-access memory. Memory that does not lose its contents when you turn off your system. NVRAM is used for maintaining the date, time, and system configuration information.

parity — Redundant information that is associated with a block of data.

partition — You can divide a hard drive into multiple physical sections called *partitions* with the **fdisk** command. Each partition can contain multiple logical drives. You must format each logical drive with the **format** command.

PCI — Peripheral Component Interconnect. A standard for local-bus implementation.

PDU — Power distribution unit. A power source with multiple power outlets that provides electrical power to servers and storage systems in a rack.

peripheral — An internal or external device, such as a diskette drive or keyboard, connected to a system.

PGA — Pin grid array. A type of processor socket that allows you to remove the processor chip.

pixel — A single point on a video display. Pixels are arranged in rows and columns to create an image. A video resolution, such as 640 x 480, is expressed as the number of pixels across by the number of pixels up and down.

POST — Power-on self-test. Before the operating system loads when you turn on your system, the POST tests various system components such as RAM and hard drives.

processor — The primary computational chip inside the system that controls the interpretation and execution of arithmetic and logic functions. Software written for one processor must usually be revised to run on another processor. *CPU* is a synonym for processor.

protected mode — An operating mode that allows operating systems to implement:

- A memory address space of 16 MB to 4 GB
- Multitasking
- Virtual memory, a method for increasing addressable memory by using the hard drive

The Windows 2000 and UNIX 32-bit operating systems run in protected mode. MS-DOS cannot run in protected mode.

PS/2 — Personal System/2.

PXE — Preboot eXecution Environment. A way of booting a system via a LAN (without a hard drive or bootable diskette).

RAC — Remote access controller.

RAID — Redundant array of independent disks. A method of providing data redundancy. Some common implementations of RAID include RAID 0, RAID 1, RAID 5, RAID 10, and RAID 50. See also *guarding*, *mirroring*, and *striping*.

RAM — Random-access memory. The system's primary temporary storage area for program instructions and data. Any information stored in RAM is lost when you turn off your system.

RAS — Remote Access Service. This service allows users running the Windows operating system to remotely access a network from their system using a modem.

readme file — A text file, usually shipped with software or hardware, that contains information supplementing or updating the product's documentation.

read-only file — A read-only file is one that you are prohibited from editing or deleting.

ROM — Read-only memory. Your system contains some programs essential to its operation in ROM code. A ROM chip retains its contents even after you turn off your system. Examples of code in ROM include the program that initiates your system's boot routine and the POST.

ROMB — RAID on motherboard.

rpm — Revolutions per minute.

RTC — Real-time clock.

SAS — Serial-attached SCSI.

SATA — Serial Advanced Technology Attachment. A standard interface between the system board and storage devices.

SCSI — Small computer system interface. An I/O bus interface with faster data transmission rates than standard ports.

SDRAM — Synchronous dynamic random-access memory.

sec — Second(s).

serial port — An I/O port used most often to connect a modem to your system. You can usually identify a serial port on your system by its 9-pin connector.

service tag — A bar code label on the system used to identify it when you call Dell for technical support.

simple disk volume — The volume of free space on a single dynamic, physical disk.

SMART — Self-Monitoring Analysis and Reporting Technology. Allows hard drives to report errors and failures to the system BIOS and then display an error message on the screen.

SMP — Symmetric multiprocessing. Used to describe a system that has two or more processors connected via a high-bandwidth link and managed by an operating system, where each processor has equal access to I/O devices.

SNMP — Simple Network Management Protocol. A standard interface that allows a network manager to remotely monitor and manage workstations.

spanning — Spanning, or concatenating, disk volumes combines unallocated space from multiple disks into one logical volume, allowing more efficient use of all the space and all drive letters on a multiple-disk system.

striping — Disk striping writes data across three or more disks in an array, but only uses a portion of the space on each disk. The amount of space used by a "stripe" is the same on each disk used. A virtual disk may use several stripes on the same set of disks in an array. See also *guarding*, *mirroring*, and *RAID*.

SVGA — Super video graphics array. VGA and SVGA are video standards for video adapters with greater resolution and color display capabilities than previous standards.

system board — As the main circuit board, the system board usually contains most of your system's integral components, such as the processor, RAM, controllers for peripherals, and various ROM chips.

system configuration information — Data stored in memory that tells a system what hardware is installed and how the system should be configured for operation.

system diskette — See *bootable diskette*.

system memory — See *RAM*.

System Setup program — A BIOS-based program that allows you to configure your system's hardware and customize the system's operation by setting features such as password protection. Because the System Setup program is stored in NVRAM, any settings remain in effect until you change them again.

system.ini file — A start-up file for the Windows operating system. When you start Windows, it consults the **system.ini** file to determine a variety of options for the Windows operating environment. Among other things, the **system.ini** file records which video, mouse, and keyboard drivers are installed for Windows.

TCP/IP — Transmission Control Protocol/Internet Protocol.

termination — Some devices (such as the last device at each end of a SCSI cable) must be terminated to prevent reflections and spurious signals in the cable. When such devices are connected in a series, you may need to enable or disable the termination on these devices by changing jumper or switch settings on the devices or by changing settings in the configuration software for the devices.

TOE — TCP/IP offload engine. A technology to improve data-transfer performance over IP networks by allowing the operating system to offload all TCP/IP traffic to specialized hardware on the network adapter, while leaving TCP/IP control decisions to the host server.

UNIX — Universal Internet Exchange. UNIX, the precursor to Linux, is an operating system written in the C programming language.

uplink port — A port on a network hub or switch used to connect to other hubs or switches without requiring a crossover cable.

UPS — Uninterruptible power supply. A battery-powered unit that automatically supplies power to your system in the event of an electrical failure.

USB — Universal Serial Bus. A USB connector provides a single connection point for multiple USB-compliant devices, such as mice and keyboards. USB devices can be connected and disconnected while the system is running.

utility — A program used to manage system resources—memory, disk drives, or printers, for example.

UTP — Unshielded twisted pair. A type of wiring used to connect systems in a business or home to a telephone line.

V — Volt(s).

VAC — Volt(s) alternating current.

VDC — Volt(s) direct current.

VGA — Video graphics array. VGA and SVGA are video standards for video adapters with greater resolution and color display capabilities than previous standards.

video adapter — The logical circuitry that provides (in combination with the monitor) your system's video capabilities. A video adapter may be integrated into the system board or may be an expansion card that plugs into an expansion slot.

video driver — A program that allows graphics-mode application programs and operating systems to display at a chosen resolution with the desired number of colors. Video drivers may need to match the video adapter installed in the system.

video memory — Most VGA and SVGA video adapters include memory chips in addition to your system's RAM. The amount of video memory installed primarily influences the number of colors that a program can display (with the appropriate video drivers and monitor capabilities).

video resolution — Video resolution (800 x 600, for example) is expressed as the number of pixels across by the number of pixels up and down. To display a program at a specific graphics resolution, you must install the appropriate video drivers and your monitor must support the resolution.

W — Watt(s).

WH — Watt-hour(s).

win.ini file — A start-up file for the Windows operating system. When you start Windows, it consults the **win.ini** file to determine a variety of options for the Windows operating environment. The **win.ini** file also usually includes sections that contain optional settings for Windows application programs that are installed on the hard drive.

Windows 2000 — An integrated and complete Microsoft Windows operating system that does not require MS-DOS and that provides advanced operating system performance, improved ease of use, enhanced workgroup functionality, and simplified file management and browsing.

Windows Powered — A Windows operating system designed for use on NAS systems. For NAS systems, the Windows Powered operating system is dedicated to file service for network clients.

Windows Server 2003 — A set of Microsoft software technologies that enable software integration through the use of XML Web services. XML Web services are small reusable applications written in XML that allow data to be communicated between otherwise unconnected sources.

XML — Extensible Markup Language. XML is a way to create common information formats and to share both the format and the data on the World Wide Web, intranets, and elsewhere.

ZIF — Zero insertion force.

Index

processor
  installing, 65
  removing, 62
  replacing, 65
  troubleshooting, 95

R

recommended tools, 39

removing
  3.5-inch drive, 44
  bezel, 73
  CD/DVD drive, 47
  chassis intrusion switch, 71
  cooling fans, 65
  diskette drive, 44
  expansion cards, 56
  front drive bezel, 42
  hard drive, 51
  I/O panel, 74
  memory, 60
  power supply, 69
  processor, 62
  system battery, 67
  system board, 76
  tape drive, 47

replacing
  bezel, 74
  chassis intrusion switch, 72
  cooling fans, 67
  diskette drive, 45
  expansion cards, 57
  front drive bezel, 43
  I/O panel, 76
  memory, 60

replacing *(continued)*
  power supply, 70
  processor, 65
  system board, 78

S

safety, 79

SAS controller card
  installing, 58
  troubleshooting, 92

SAS hard drive. *See* hard drive.

SATA hard drive. *See* hard drive.

securing your system, 36

serial port
  connector, 13
  troubleshooting, 82

setup password features, 35

startup
  accessing system features, 10

status messages
  systems management, 16

support
  contacting Dell, 112

system
  closing, 41
  opening, 41

system battery
  removing, 67

system board
  connectors, 103
  installing, 78
  jumpers, 101
  removing, 76
  replacing, 78

system cooling
  troubleshooting, 86

system features
  accessing, 10

system messages, 16

system password
  assigning, 35
  changing, 37
  deleting, 36
  using, 35

system password features, 35

system setup program
  entering, 27
  options, 28
  using, 27

system setup screens
  drive options, 30
  main, 28
  maintenance options, 34
  onboard devices options, 31
  performance options, 31
  POST behavior options, 34
  power management
    options, 33
  security options, 32
  system options, 29